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TREASURY DEPARTMENT.

Public Health and Marine-Hospital Service of the United States.

WALTER WYMAN, Surgeon-General.

HYGIENIC LABORATORY.—BULLETIN No. 25.

M. J. ROSENAU, Director.

June, 1906

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ILLUSTRATED KEY

TO THE

CESTODE PARASITES OF MAN.

BY

CH. WARDELL STILES.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1906.

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No. 15. Inefficiency of ferrous sulphate as an antiseptic and germicide. By Allan J. McLaughlin.

No. 16. The antiseptic and germicidal properties of glycerin. By M. J. Rosenau.

No. 17. Illustrated key to the trematode parasites of man. By Ch. Wardell Stiles.

No. 18. An account of the tapeworms of the genus *Hymenolepis* parasitic in man, including reports of several new cases of the dwarf tapeworm (*H. nana*) in the United States. By Brayton H. Ransom.

[Continued on third page of cover.]

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United States Public Health and Marine-Hospital Service.

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ILLUSTRATED KEY TO THE CESTODE PARASITES OF MAN.

By Ch. Wardell Stiles, Ph. D., Chief of Division of Zoology, Hygienic Laboratory, U. S. Public Health and Marine-Hospital Service.

INTRODUCTION.

The present paper is intended as a companion to the "Illustrated Key to the Trematode Parasites of Man," Bull. 17, of this laboratory, and includes all of the cestodes, both adults (tapeworms) and larvæ (bladder worms) known to occur in man.

The more important species for American physicians are at present: *Tænia saginata*, *T. solium*, *Hymenolepis nana*, *Echinococcus*, and *Dibothriocephalus latus*. In addition to these, *Tænia confusa* may prove to be an important parasite, more particularly in the Northwest. It is a little difficult to forecast which forms will prove to be of importance in the Philippines, but in addition to the first five species mentioned above, *Diplogonoporus grandis* and *Sparganum mansoni* should be held in mind as possibilities.

CLINICAL CLASSIFICATION OF CESTODE INFECTIONS (TÆNIASES).

Tænia was the original (1758) genus of tapeworms, and infections by any member of the group may conveniently be referred to as tæniasis. The following clinical forms may be distinguished:

Intestinal tæniasis: This is the more common form and includes the infection with adult tapeworms; diagnosis by finding the segments in the stools, in the bed, or in the clothes, or by finding the eggs in microscopic examination of the stools; treatment medicinal, by administering tæniacides or tæniafuges (male fern, cusso, kamala, pomegranate, pumpkin seed, etc.) (p. 11).

Somatic tæniasis: This includes infections of muscles, connective tissue, liver, lungs, brain, eye, or other organs, with the larval stage of tapeworms, and we may distinguish—

(a) *Cysticercosis:* Infection with the larva of *Tænia solium*, known as *Cysticercus cellulosæ*, which occurs chiefly in the muscles, connective tissue, eye, and brain; diagnosis by excision, or by ophthalmoscopic examination, or by symptoms, especially when combined with a history of intestinal infection with *Tænia solium;* treatment surgical (p. 68).

(b) *Echinococcosis:* Infection with the hydatid stage of *Echinococcus* of dogs; it may occur in any organ, but chiefly in liver and lungs; diagnosis by symptoms or by aspiration and microscopic examination of the fluid to find the hooks or the heads; treatment surgical (p. 75).

(c) Infection with *Sparganum mansoni;* rare; diagnosis by finding the worm; treatment surgical, or by extraction of worm per urethram (p. 83).

(d) Infection with *Sparganum proliferum;* rare; Japan; diagnosis by finding the worm; treatment surgical (p. 86).

THE PARASITES OF TÆNIASIS.

The cestodes differ from the trematodes by the usual presence of a distinct head with 2 or 4 suckers, by the segmented condition of the adult, each segment or proglottid representing, roughly speaking, a single trematode, so that the entire chain (strobila) may be viewed as a colony, and by the absence of an intestine. All of the species found in man are hermaphrodites.

ANATOMICAL STRUCTURE OF CESTODES.

The following technical description shows the systematic position and anatomical structure of the tapeworms under discussion:

- Superfamily *Dibothriocephaloidea.*
  - Family *Dibothriocephalidæ.*
    - Genera *Dibothriocephalus*, *Diplogonoporus*, and *Sparganum.*
- Superfamily *Tænioidea.*
  - Family *Tæniidæ.*
    - Subfamily *Dipylidiinæ.*
      - Genera *Dipylidium* and *Hymenolepis.*
    - Subfamily *Daraineinæ.*
      - Genus *Darainea.*
    - Subfamily *Tæniinæ.*
      - Genera *Tænia* (with subgenera *Tænia* and *Tæniarhynchus*) and *Echinococcus.*

The *head* or *scolex* is provided with 2 (*Dibothriocephalida*) or 4 (*Tæniidæ*) suckers (*acetabula*) which may (*Darainea*) be provided with *hooks;* on its apex it has (*Tæniidæ*) a *rostellum*, which in most species is armed with *hooks;* the head contains the brain and in some worms a circular excretory ring. *Lateral nerves* extend from the brain through the entire strobila to the distal end. *Lateral canals* extend from the circular ring distally through the segments; in the *Tæniidæ* are distinguished *dorsal* and *ventral canals*, the latter being connected at the distal end of each segment by a *transverse canal.* The head is followed by a *neck*, which segments transversely to form the *proglottides.* Each proglottid or segment contains a full set (in some cases two sets) of both male and female organs. The *genital pores* are lateral (*Tæniida*) or ventral (*Dibothriocephalidæ*). The *male glands* consist of *testicles*, which vary in number; from these extend *vasa efferentia* which collect to form the *vas deferens;* the latter enters the *cirrus-pouch*, from which the *cirrus* (penis) is extruded. The *female* opening is close to the cirrus; the *vagina* runs toward the genital glands, swelling to a *receptaculum seminis;* the glands are: *shell gland*, *ovary*, and *vitellogene gland;* the fertilized egg enters the *uterus*. These different organs vary in different genera and species (see keys, pp. 11, 15, 25, 48, 51, 62).

The embryo (*onchosphere*) is provided with 6 minute hooks; it enters an intermediate host and develops into a so-called larval stage (cysticercus, echinococcus, cysticercoid, plerocercoid), in which the head forms; upon being swallowed by the final host, the head attaches itself to the intestine and the segments form by transverse strobilation of the neck.

INTESTINAL TÆNIASIS.

From a clinical point of view the most important tapeworms for man are at present three large forms (*Tænia saginata*, *T. solium*, and *Dibothriocephalus latus*) and one small species (*Hymenolepis nana*); in fact, nearly our entire knowledge of intestinal tæniasis in man is based upon these four species. The other species reported for man are relatively of less importance, since they are less frequent. The following genera are reported for man:

KEY[a] TO GENERA OF ADULT CESTODES FOUND IN MAN.

(For genera thus far reported for man in the United States, follow roman type.)

1. Head with two elongate or slit-like suckers; uterus forms a rosette; genital pores ventral 2
Head with four cup-shaped suckers; uterus does not form a rosette; genital pores lateral (marginal) 3

DIBOTHRIOCEPHALIDÆ.

2. Single set of genital pores and uteri present in ventro-median line; chiefly Old World .... *Dibothriocephalus* (p. 15)
Double set of pores and uteri present in ventro-submedian lines; Asiatic .... *Diplogonoporus* (p. 21)

TÆNIIDÆ.

3. Large forms; gravid segments over one-third of an inch (9 to 35 mm.) long; uterus median with lateral branches .... *Tænia* (p. 24)
Smaller forms; ripe segments less than one-third of an inch (to 7 mm.) long 4
4. Genital pores single; rostellum with not more than 2 rows of hooks 5
Genital pores double; rostellum with several rows of hooks .... *Dipylidium* (p. 48)
5. Suckers not armed; 3 testicles in each segment .... *Hymenolepis* (p. 51)
Suckers armed with hooks; about 15 to 50 testicles in each segment .... *Davainea* (p. 62)

CLINICAL DIAGNOSIS OF INTESTINAL TÆNIASIS.

The clinical diagnosis of intestinal tapeworms may be made by finding the segments passed from the anus, or by microscopic examination of the stools to find the eggs. For the microscopic examination no special technique is required. Take a small amount of fecal matter on the end of a match or toothpick (using a separate one for each stool), smear this in a drop of water on a slide, cover with cover slip, and examine first under a medium-power and later under a high-power dry lens. In some cases (*Dibothriocephalus* and *Diplogonoporus*) there is a chance of confusing the eggs with those of trematodes; see key, p. 9, in Illustrated Key to Trematode Parasites of Man. In these examinations the 2 by 3 slide is more convenient to work with than the ordinary 1 by 3 slide.

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[a] This key is based primarily upon the species found in man, and on this account should not be relied upon for other species found in other animals.

KEY TO THE EGGS OF TAPEWORMS REPORTED FOR MAN.

(For species thus far found in man in the United States follow roman type.)

1. Eggs provided with a "cap" or operculum, like the egg of certain liver flukes, but not containing an embryo when found in the stools; *Dibothriocephalidæ* 9
   Eggs not provided with "cap" or operculum; round to oval; may occur in clusters ("egg sacks"), and always contain a 6-hooked embryo (onchosphere) when found in the stools; *Tæniidæ* 2

TÆNIIDÆ.

2. Egg with thick, radially striated inner shell (embryophore); *Tæniinæ* 3
   Egg with thin, membranous, inner shell 6

TÆNIA.[a]

3. *Occurrence in man doubtful; rare if they occur at all* 5
   Positively known to occur in man 4
4. Embryophore (inner shell) ovoid, rusty brown, 35 to 40 by 20 to 30 μ; outer shell delicate with 1 or 2 polar filaments, not usually present on eggs in feces; this is the most common *Tænia* in the United States; the fat tapeworm .... *Tænia saginata* (p. 27)
   Embryophore almost round, usually brown, 31 to 36 μ; comparatively rare in the United States; the pork tapeworm .... *T. solium* (p. 37)
   Embryophore oval, whitish to yellowish, 39 by 30 μ; reported for Nebraska; Ward's tapeworm .... *T. confusa* (p. 44)
   Embryophore 31 to 39 by 33.8 μ; reported for Africa .... *T. africana* (p. 32)
   Egg unknown; reported for Asiatic Russia .... *T. hominis* (p. 36)
5. *Embryophore ovoid, 36 to 40 by 31 to 36 μ* .... *T. pisiformis* (p. 41)
   Embryophore globular, 31 to 37 μ .... *T. teniæformis* (p. 43)
6. Eggs occur in egg-sacks 8
   Eggs do not occur in egg-sacks 7

HYMENOLEPIS.

7. Eggs oval or globular; 2 distinct membranes; outer membrane 30 to 60 μ; inner membrane 16 to 34 μ, presenting at each pole a more or less conspicuous mammillate projection; common in some localities; the dwarf tapeworm .... *H. nana* (p. 51)
   Eggs round or slightly oval; outer membrane 54 to 86 μ; yellowish, may be radially striated; inner membrane 24 to 40 by 20 to 35 μ, with mammillate projection at each pole, often not apparent; rare in man .... *H. diminuta* (p. 54)
   Eggs oval or spherical; outer membrane 50 to 100 by 35 to 100 μ; inner membrane 30 to 40 by 25 μ, occasionally with polar papillæ; exceedingly rare in man .... *H. lanceolata* (p. 58)

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[a] It is not always safe to rely upon the egg alone in distinguishing the different species.

DIPYLIDIUM AND DAVAINEA.

8. Eggs spherical, 43 to 50 μ; 8 to 20 eggs in each egg capsule; accidental in man, chiefly in children .... *Dipylidium caninum* (p. 50)
Eggs with 2 shells, the outer with 2 mammillate projections; onchosphere (embryo) 8 μ; 1 to 3 eggs in each egg-ball, with calcareous corpuscles; tropical and subtropical .... *Davainea madagascariensis* (p. 63)
Mature eggs not yet observed, but probably about 38.6 by 36.4 μ; egg-balls without calcareous corpuscles; Asiatic .... *D. asiatica* (p. 65)

DIBOTHRIOCEPHALIDÆ.

9. Eggs 68 to 71 by 45 to 50 μ; chiefly Old-World form, occasionally in America; the broad tapeworm .... *Dibothriocephalus latus* (p. 15)
Eggs 75 to 80 by 50 μ; Greenland .... *D. cordatus* (p. 19)
Eggs brownish, 63 by 48 to 50 μ; Asiatic .... *Diplogonoporus grandis* (p. 22)

SYMPTOMS.

The symptomatology of intestinal tæniasis is indefinite. There may be giddiness, humming in the ears, disorders of vision, nasal and anal pruritus, salivation, disorders of appetite and digestion, colic, pains in epigastrium and other regions of abdomen, cardiac palpitation, syncope, pains and lassitude in limbs, emaciation, anemia, etc.

TREATMENT.

In treatment it should be recalled that (*a*) the clearer the bowels are the better are the chances for success, (*b*) the older the drug is the less are the chances for success, and (*c*) the nervous system of the tapeworm is well developed, hence the parasites are susceptible to a sudden change in temperature.

(a) *Preparation of patient.*—Clear out the bowels, so that the drug can reach the parasite and so that the latter will not meet with obstructions while descending to the anus. The diet should be light, avoiding vegetables and any foods which tend to the production of large quantities of feces.

(b) *Anthelmintic.*—Doubtless many failures in treatment are due to using old drugs which have lost their anthelmintic properties.

(c) *Passage of the worm.*—The patient should be instructed to pass the worm into a vessel containing *warm* water. Under no circumstances should he pass the worm into a water-closet, as the parasite, upon coming in contact with a cold object, may contract and break.

PREVENTION.—The method of prevention varies according to the different species. As all intestinal tapeworms are contracted *per os*, prevention involves a care of the food eaten. All tapeworm segments and stools should be burned, unless used for scientific study. See also under the different species.

Superfamily DIBOTHRIOCEPHALOIDEA.[a]

Ordinal diagnosis.—*Cestoda:* Scolex armed or unarmed, with two groove-like suckers, situated dorsally and ventrally; they are usually not highly developed, but in some cases are considerably modified by development of their walls, or by more or less coalescence of their margins; or they may unite to form a single apical sucker, or may become rudimentary, their function being performed by an unpaired apical sucker; in some cases a pseudoscolex may form. Neck present or absent. External segmentation present or absent. Three genital pores present; uterine pore is always on one of the surfaces; the vaginal and cirrus pores may be on the same surface as the uterine or on the opposite surface or marginal. Genital organs usually single, rarely double. Their development progresses from anterior end posteriorly, but does not pass the mature stage into an atrophying stage. Testicles numerous, situated in two more or less separated lateral fields in the medullary layer; vas deferens always highly developed, usually forming a coil. Ovary distinctly or indistinctly bipartite, situated in distal portion of segment, usually median in forms with single series of genitalia; in forms with double series, submedian; in forms with lateral pores, on side of median line toward the pore. "Schluckorgan" always present. Vitellogene glands with numerous follicles, situated in two, more or less separated lateral fields, nearly always dorsal and ventral, and usually in cortical layers. Eggs quite similar to those of *Fasciola*, but not always with operculum.

Type family.—*Dibothriocephalidæ.*

This superfamily may be divided into two families (*Dibothriocephalidæ* and *Ptychobothriidæ*), only one of which furnishes parasites to man, namely:

Family DIBOTHRIOCEPHALIDÆ[b] Luehe, 1899, emend. Braun, 1903.

Family Diagnosis.—*Dibothriocephaloidea* (p. 14): Uterus forms a rosette. Eggs with operculum.

Type genus.—*Dibothriocephalus* Luehe, 1899.

This family is divided into 4 subfamilies (*Tricuspidariinæ*, *Dibothriocephalinæ*, *Ligulinæ*, and *Cyathocephalinæ*), only one of which is represented among the intestinal parasites of man, namely:

Subfamily DIBOTHRIOCEPHALINÆ Luehe, 1899.

Subfamily diagnosis.—*Dibothriocephalidæ* (p. 14): Scolex unarmed; suckers either two small grooves (one dorsal and one ventral) or two funnel-shaped organs with highly developed borders, or by coalesence of their borders changed to sucker-tubes, or rudimentary and then replaced by an apical sucker. Neck present or absent. External segmentation complete. Genital organs single or double. Genital pores ventral, median or submedian; cirrus, vagina, and uterine pores in a longitudinal row, in order named; genital atrium, into which cirrus and vagina open, is provided with numerous papillæ. Ovary ventral and shell gland dorsal, always median in forms with single sets of pores. Vitellogene follicles always in cortical layer. Vas deferens very sinuous, running dorsally and changing to a globular or pyriform vesicula seminalis before opening into the cirrus pouch. Testicles in the medullary layer, for the greater part outside of the longitudinal bands. The vagina, extending ventrally, crosses the uterus near its pore, and widens to a receptaculum seminis (the limits of which are not distinctly defined distally, but distinctly defined proximally) opposite the narrow and short seminal canal which unites with the oviduct to form the fertilization canal. Uterus often forms a "rosette." Eggs with operculum.

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[a] Synonym.—*Pseudophyllidea* Carus, 1863; *Bothriocephaloidea* Braun, 1903.

[b] Synonym.—*Bothriocephalidæ* of authors.

Larval stages, for most species, unknown; adult in intestine of mammals, birds, and reptiles.

Type genus.—*Dibothriocephalus* Luehe, 1899.

Of the six genera *Dibothriocephalus*, *Duthiersia*, *Scyphocephalus*, *Bothridium*, *Diplogonoporus*, and *Pyramicocephalus*, only two (*Dibothriocephalus* and *Diplogonoporus*, for key see p. 11) are reported for man. See also *Sparganum*, p. 83.

Genus DIBOTHRIOCEPHALUS Luehe, 1899.

Generic diagnosis.—*Dibothriocephalinæ* (p. 14): Scolex more or less elongate, groove-like suckers not highly developed. Neck present or absent. Genital organs in single series. Testicles and vitellogene glands in the lateral fields, occasionally anterior and posterior in the median field, in some cases reaching the median line. Vitellogene follicles, at least in part, situated between inner and outer longitudinal muscle layer. Uterus a long canal, in middle field, forming a rosette. Parasitic in man, felines, canines, pennipedia, and water birds. Larva (plerocercoid) in fish.

Type species.—*Dibothriocephalus latus* (Linnæus, 1758) Luehe, 1899.

The 2 species of this genus which occur in man may be distinguished by the following key:

KEY TO THE SPECIES OF DIBOTHRIOCEPHALUS REPORTED FOR MAN.[a]

Head oblong; strobila 2 to 10 meters or more long, 20 mm. in maximum breadth; with 3,000 to 4,000 segments; the broad tapeworm .... *D. latus* (p. 15)

Head cordiform; strobila 80 to 115 cm. long, not over 8 mm. broad; 400 to 660 segments present; found in Greenland; rare in man .... *D. cordatus* (p. 19)

The Broad Tapeworm—DIBOTHRIOCEPHALUS LATUS[b] (Linnæus, 1758) Luehe, 1899.

[Figs. 1 to 13.]

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[a] Ward's new bothriocephalid tapeworm, 1906.—Since this bulletin was sent to press, Ward has announced that he has obtained specimens of an apparently undescribed bothriocephalid tapeworm, taken from a six-year-old child, in the prairie region of North America; the patient had eaten raw fish. Details will be published later by Ward.

[b] Synonyms.—*Tænia lata* Linnæus, 1758a; *T. vulgaris* Linnæus, 1758a; *T. grysea* Pallas, 1761; *T. membranacea* Pallas, 1781; *T. tenella* Pallas, 1781; *T. lata hominis* Bloch, 1782a; *T. vulgaris* vel *grisea* vel *membranacea* Fischer, 1789a; *T. lata* vel *candida* Fischer, 1789a; *T. tenella* Fischer, 1789a; *T. vulgaris* Gmelin, 1790a; *Tenia inerme umana* Brera, 1802a; *Tænia inermis* Weber's Brera, 1803a [not Moquin-Tandon, 1860]; *Halysis lata* (Linnæus, 1758) Zeder, 1803a; *H. membranacea* (Pallas, 1781) Zeder, 1803a; *Tænia humana inermis* Rudolphi, 1810a; *Botryocephalus hominis* Lamarck, 1816; *Bothriocephalus latus* (Linnæus, 1758) Bremser, 1819a; *Dibothrium latum* (Linnæus, 1758) Diesing, 1850a; *Bothriocephalus cristatus* Davaine, 1873a; *Tænia fenestrata* Colin, 1876a; *Botriocephalus vulgaris cristatus* (Davaine, 1873) Grassi, 1880a; *B. vulgaris latus* (Linnæus, 1758) Grassi, 1880a; *B. vulgaris tenellus* (Pallas, 1781) Grassi, 1880a; *B. tenellus* (Pallas, 1781) Grassi, 1880a; *Bothriocephalus latus tenellus* (Pallas, 1781) Guzzardi Asmundo, 1885a; *B. latissimus* Burgnion, 1886; *B. dorpatensis* Thoma in Kuechenmeister, 1886c; *B. balticus* Thoma in Kuechenmeister, 1886c; *Bothriocephalus latus fenestr*[*atus*] Maggiora, 1891; *B. fenestratus* Maggiora, 1891; *Dibothriocephalus latus* (Linnæus, 1758) Luehe, 1899; *D. cristatus* (Davaine, 1873) Luehe, 1899.

Bibliography.—For zoological discussion, see Leuckart, 1886, 864–929, figs. 357–393; for medical literature, see Stiles & Hassall, Index-Catalogue of Medical and Veterinary Zoology.

SPECIFIC DIAGNOSIS.—*Dibothriocephalus* (p. 15): Strobila attains 2 to 10 [or 20?] meters in length and 20 mm. in width; usually grayish yellow to brown in color; composed of 3,000 to 4,200 segments usually broader than long, especially in anterior two-thirds of strobila; posterior segments become quadrate or even longer than broad, like the segments of *Tænia*. Head oblong, almond shaped, 2 to 3 mm. long, 0.7 to 1 mm. broad, with groove-like suckers. Neck long, or short, thin. Gravid segments usually measure 2 to 4 mm. long by 10 to 12, even 20 mm. broad; they gradually lose their eggs, so that posterior segments may be entirely devoid of them. Uterus with 4 to 6 loops each side of the median line. Calcareous corpuscles few. Eggs may appear 600 segments back of the head; they are brownish, elliptical, with a small operculum, and measure 68 to 71 μ by 44 to 45 μ; laid during segmentation. Segments break loose in chains instead of singly.

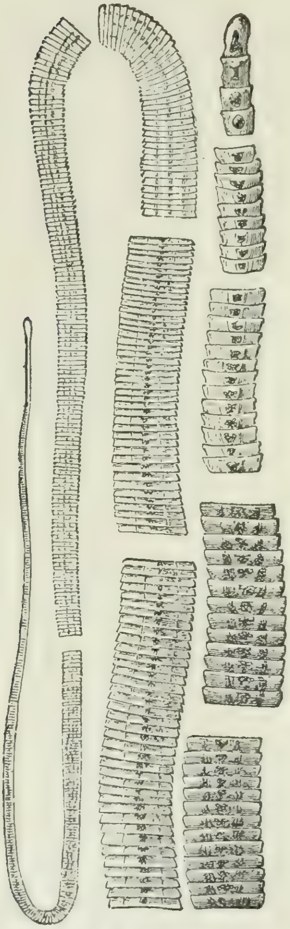


FIG. 1.—Strobila of the Broad Tapeworm (*Dibothriocephalus latus*); note the row of rosettes (uterus) in the median line. Natural size. (After Leuckart, 1886, 865, fig. 357.)

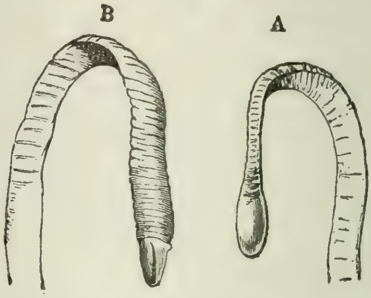


FIG. 2.—Head and anterior end of same: *a*, side view of head; *b*, ventral or dorsal view of head. × ca. 8. (After Leuckart, 1886, 865, fig. 358.)

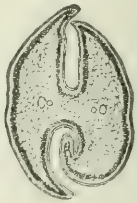


FIG. 3.—Tranverse sections of head of *D. latus*, to show form of suckers. × 31. (After Braun, 1903, 190, fig. 141.)

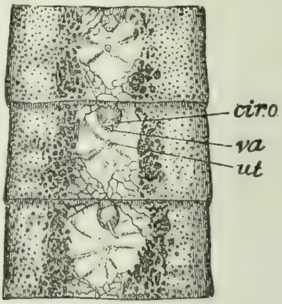


FIG. 4.—Ventral view of three segments of *D. latus*: *cir. o.*, male pore; *va.*, vagina; *ut.*, opening of uterus, through which eggs escape; in the third segment the cirrus (penis) is extruded. Enlarged. (After Eschricht, from Railliet, 1893a, 316, fig. 205.)

Plerocercoid: In muscles of fish.

HABITAT.—Adult in intestine of man, dogs, cats, foxes; larva a plerocercoid in various fishes—common pike (*Esox lucius*), ling (*Lota lota*), perch (*Perca fluviatilis*), several members of the salmon family (*Salmo umbla*, *S. trutta*, *S. lacustris*, *Thymallus vulgaris*, *Coregonus lavaretus*, *C. albula*, *Onchorhynchus kisutch*, and perhaps *Salmo salar*).

GEOGRAPHIC DISTRIBUTION.—Reported particularly from the Baltic provinces, French Switzerland, and Japan. From these districts it has spread into France, Italy, Germany, Russia, Finland, Sweden, Denmark, Holland, Belgium, and Ireland; it is also reported for Madagascar, and a few cases are known for the United States. In some localities 5 to 20 per cent of the inhabitants are alleged to harbor the worm.

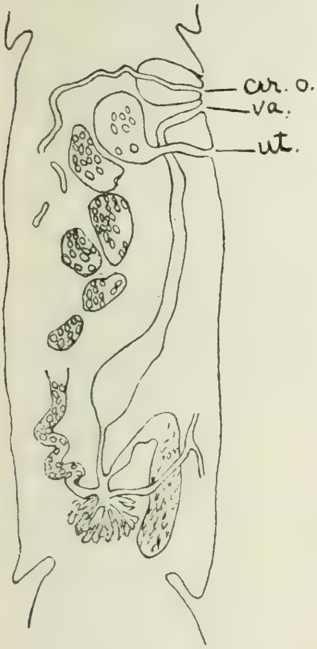


FIG. 5.—Longitudinal, sagittal section of similar segment, showing the relative position of the three genital pores. Enlarged. (After Leuckart, 1886, 877, fig. 363.)

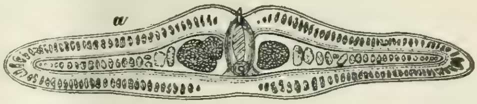


FIG. 6.—Transverse section of a segment at height of cirrus-pouch, to show the relative position of organs. × 10. (After Leuckart, 1886, 878, fig. 364.)

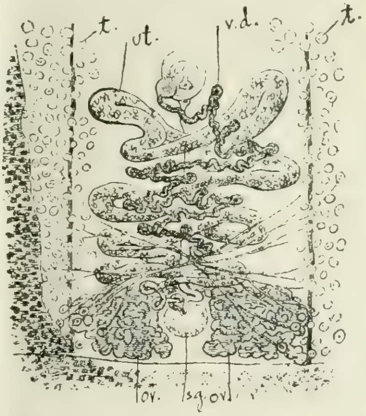


FIG. 7.—Dorsal view of genital organs: *ov.*, ovary; *s. g.*, shell gland; *t.*, testicles; *ut.*, uterus; *v. d.*, vas deferens. × 20. (After Leuckart, 1886, 882, fig. 365.)

SPECIAL MEDICAL SIGNIFICANCE.—A number of patients exhibit anemia, known as Bothriocephalus-anemia. Anemia is more likely to develop in case of infection with this parasite than it is with any other tapeworm.

Upon infection the worm grows at a rate of 31 to 32 segments per day, about 2.2 to about 9 cm. in total length; eggs may be found in the feces 24 days after infection.

PREVENTION.—Eat no raw or undercooked fish.

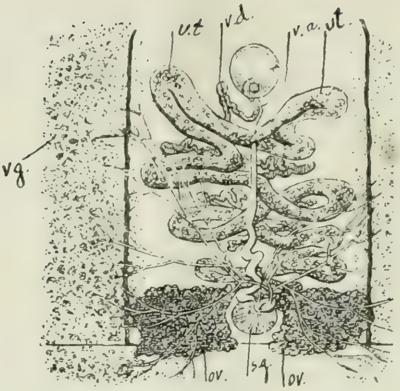


FIG. 8.—Ventral view of same, same lettering as in fig. 7: *va.*, vagina; *v. g.*, vitellogene glands. × 20. (After Leuckart, 1886, 884, fig. 366.)

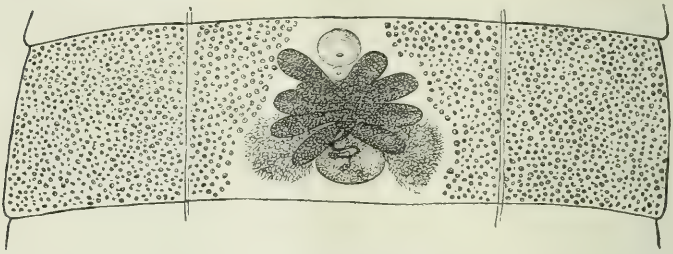
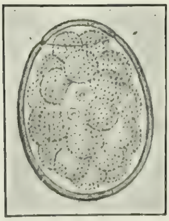


FIG. 9.—Gravid segment of *D. latus*, showing the rosette uterus in the median line. × 6. (After Leuckart, 1886, 887, fig. 368.)



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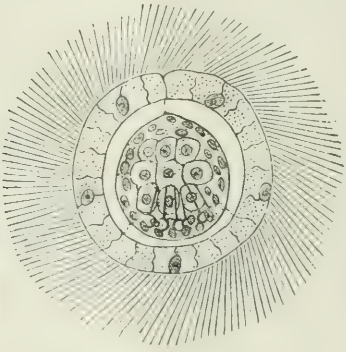

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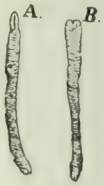

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FIG. 10.—Egg of *D. latus*. × 400. (After Looss, 1905, pl. 9, fig. 14.)

FIG. 11.—Free swimming embryo (onchosphere) of *D. latus*. Greatly enlarged. (After Schauinsland; from Braun, 1903, 200, fig. 147.)

FIG. 12.—Two larvæ (plerocercoids) of *D. latus*: *a*, with extruded head; *b*, with retracted head; from a fish (*Esox lucius*). (After Braun, 1903, 201, fig. 149.)

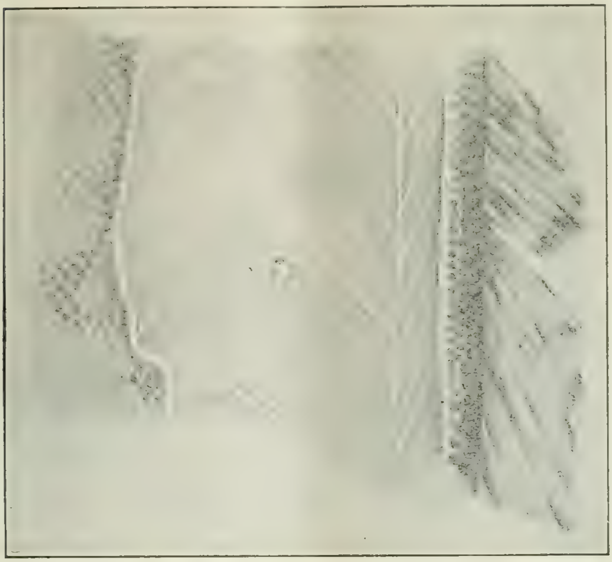

FIG. 13.—A portion of the body wall of a fish (*Lota lota*), containing a plerocercoid (infecting stage) of *D. latus*. Natural size. (After Braun, 1903, 201, fig. 150.)

The Cordate Tapeworm—DIBOTHRIOCEPHALUS CORDATUS[a] (Leuckart, 1863) Luehe, 1899.

[Figs. 14 to 20.]

Specific diagnosis.—*Dibothriocephalus* (p. 15): Similar to *D. latus*, but smaller, attaining 80 to 115 cm. in length and composed of 400 to 660 segments. Head short, broad (dorso-ventrally), heart shape or arrow-head shape, 2 by 2 mm.; suckers deep in forward half. Neck absent, segmentation beginning immediately at the head, the segments rapidly becoming broader, so that the cephalic end is more or less lanceolate; only about 50 immature segments present, genital pores and genital primordia visible in specimens 80 mm. long; at 3 cm. from head, segments attain 7 to 8 mm. in breadth and become mature; mature segments 3 to 4 mm. long, but may contract to 1.3 mm.; terminal segments nearly square 5 to 6 mm. Dorso- and ventro-median lines grooved. Calcareous corpuscles 28 to 30μ, numerous. Longitudinal muscles very well developed. Cirrus-pouch 0.6 by 0.43 mm. Uterus with 6 to 8 lateral loops each side; eggs ellipsoid 75 to 80 by 50μ.

Plerocercoid.—Unknown.

Habitat.—Adults in dogs (*Canis familiaris*) in Godhavn, North Greenland; bearded seal (*Erignathus barbatus*), Disco Island; walrus (*Odobenus rosmarus*). One case found in man in Greenland. Larva probably in fish.

Medical significance.—Unknown at present; possibly accidental in man.

Bibliography.—For zoological discussion, see Leuckart, 1886, 930–941, figs. 394–401.

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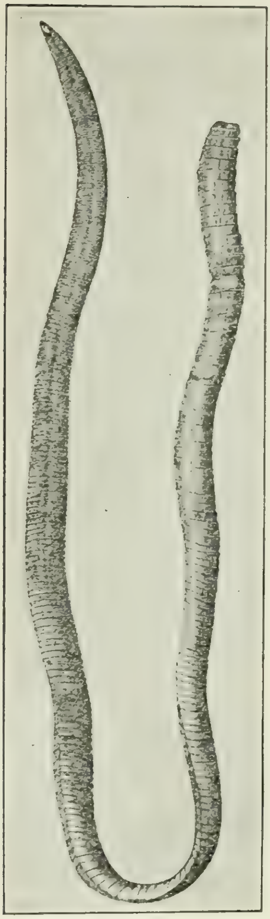
[a] Synonyms.—*Bothriocephalus cordatus* Leuckart, 1863; *Dibothrium cordatum* (Leuckart, 1863) Diesing, 1863a; *Botriocephalus cordatus* (Leuckart, 1863) Grassi, 1880a.



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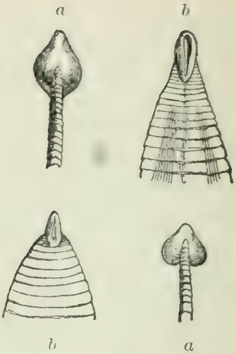

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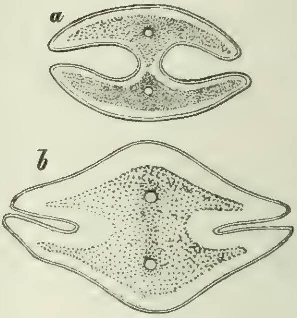

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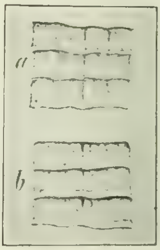

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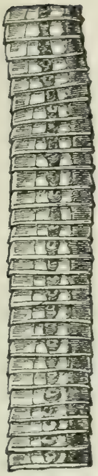
FIG. 14.—*Dibothriocephalus cordatus* from man. Natural size. (After Leuckart, 1886, 934, fig. 397.)

FIG. 15.—Head and anterior portion of *B. cordatus*: *a*, lateral view; *b*, dorsal and ventral view. ×5. (After Leuckart, 1886, 931, fig. 394.)

FIG. 16.—Transverse sections of head to show depth of suckers: *a*, in front of middle of head; *b*, back of middle of head. × ca. 10. (After Leuckart, 1886, 937, fig. 400.)

FIG. 17.—Three segments of *D. cordatus*: *a*, dorsal view; *b*, ventral view. ×2. (After Leuckart, 1886, 934, fig. 399.)



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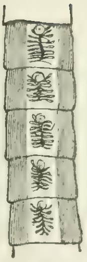

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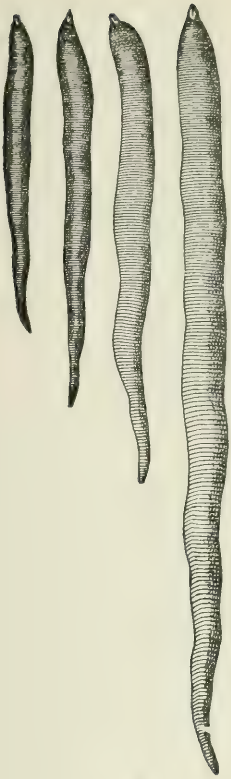

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FIG. 18.—Portion of strobila of *D. cordatus;* note rosette uterus in median line. Natural size. (After Leuckart, 1886, 931, fig. 395.)

FIG. 19.—Five segments of *D. cordatus*, showing the form of the uterus. Natural size. (After Leuckart, 1886, 931, fig. 396.)

FIG. 20.—Four young specimens of *D. cordatus*. Natural size. (After Leuckart, 1886, 939, fig. 401.)

Genus DIPLOGONOPORUS[a] Lœnnberg, 1892.

GENERIC DIAGNOSIS.—*Dibothriocephalinæ* (p. 14): Scolex short, with two strong groove-like suckers. Neck absent. Proglottids short and broad. In each segment, two sets of genital organs, otherwise like *Dibothriocephalus.* In each segment may be recognized: median field, two uterine fields, two lateral fields. Genital pores (cirrus, vaginal, uterine) in longitudinal row in uterine field; vitellogene glands and testicles in lateral and median fields. Vitellogene follicles between inner and outer longitudinal muscles. Uterus forms rosette. Parasites in man and whales.

TYPE SPECIES.—*Diplogonoporus balænopteræ* Lœnnberg, 1892.

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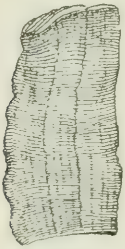
[a] SYNONYMS.—*Bothriocephalus* (*Diplogonoporus*) Lœnnberg, 1892; *Diplogonoporus* Lœnnberg, 1892, (type *balænoptera*); *Krabbea* Blanchard, 1894i (type *grandis*).

The Japanese Double-pored Tapeworm—DIPLOGONOPORUS GRANDIS[a] (Blanchard, 1894) Luehe, 1899.

[Figs. 21 to 27.]

Specific diagnosis.—*Diplogonoporus:* Strobila attains to 10 meters in length, 10 to 25 mm. in breadth; number of segments unknown. Head undescribed. Neck undescribed. Genital pores open in longitudinal genital grooves. Gravid segments contracted in alcohol to 0.45 mm. long, by 14 to 16 mm. broad. Uterus with but few (about 2) loops each side. Eggs brownish, rather opaque, 63 μ long by 48 to 50 μ broad.



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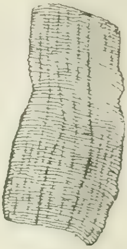

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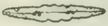

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Fig. 21.—Dorsal view of a portion of the strobila of the double-pored large tapeworm (*Diplogonoporus grandis*) of man. Natural size. (After Ijima & Kurimoto, 1894a, fig. 1.)

Fig. 22.—Ventral view of same. (After Ijima & Kurimoto, 1894a, fig. 2.)

Fig. 23.—Transverse section of same. (After Ijima & Kurimoto, 1894a, fig. 3.)

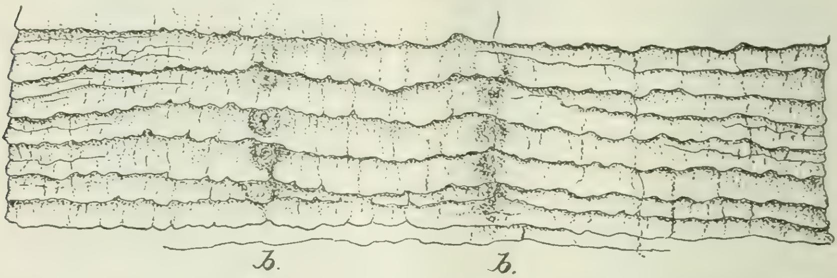

Fig. 24.—Ventral view of a portion of the strobila, showing two rows of genital pores, with partially extruded cirri. ×10. (After Ijima & Kurimoto, 1894a, fig. 6.)

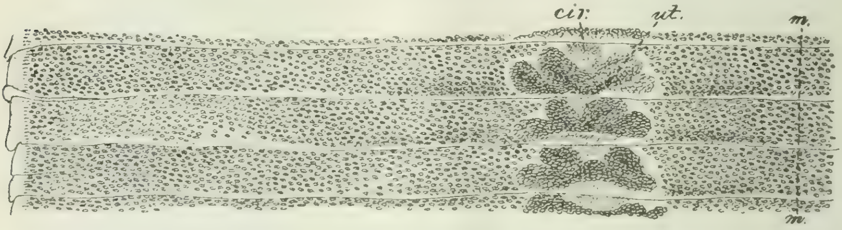

Fig. 25.—Ventral view of lateral half of same: *m*, *m*., median line of segment; *cir*., cirrus; *ut*., uterus; the numerous dot-like bodies on either side of the uteri represent the yolk glands. ×20. (After Ijima & Kurimoto, 1894a, fig. 7.)

Plerocercoid: Unknown.

Habitat.—In intestine of man, Japan; larva unknown, in all probability in fish.

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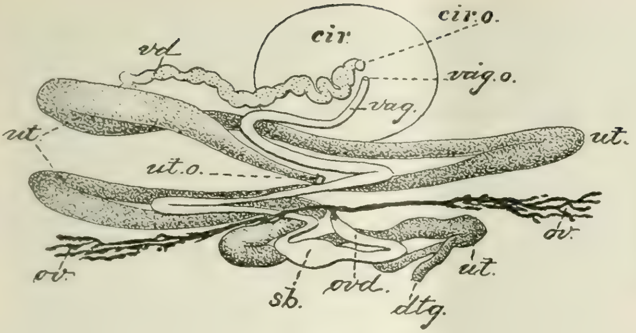
[a] Synonyms.—*Bothriocephalus* sp. Ijima & Kurimoto, 1894; *Krabbea grandis* Blanchard, 1894i.

Bibliography.—See Stiles & Tayler, 1902a, 43–47, figs. 22–28, for medical and zoological summary.



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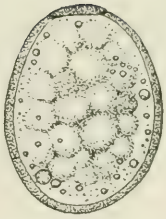

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FIG. 26.—Partially diagrammatic representation of a left set of main genital ducts as seen in ventral view: *cir.*, cirrus; *cir. o.*, cirrus opening; *dtg.*, yolk duct; *ov.*, ovary; *ovd.*, oviduct; *sb*, receptaculum seminis; *ut.*, uterus; *ut. o.*, uterine pore; *vag.*, vagina; *vag. o.*, vaginal opening; *v. d.*, vas deferens. ×150. (After Ijima & Kurimoto, 1894a, fig. 10.)

FIG. 27. An egg of *D. grandis*, taken from the uterus. ×440. (After Ijima & Kurimoto, 1894a, fig. 9.)

MEDICAL SIGNIFICANCE.—Apparently similar to *Dibothriocephalus latus*.

Superfamily TÆNIOIDEA.[a]

SUPERFAMILY DIAGNOSIS.—*Cestoda:* Scolex with four cup-shaped suckers; between these may be an apical rostellum of various forms; suckers and rostellum may be armed with hooks or unarmed. In exceptional cases a pseudoscolex develops. Neck present or absent. Segmentation nearly always complete; mature segments usually do not escape until completely developed. Uterus without special pore. Cirrus and vagina usually open on margin, exceptionally on ventral surface. Genital organs usually in single series; in some cases in double series, complete or incomplete. Testicles in medullary layer, usually numerous. Ovary more or less bilobed. Vitellogene gland usually single, and distal of ovary at distal margin of the segment, seldom anterior of ovary; shell-gland between ovary and vitellogene gland. Eggs without operculum; onchosphere with one or several membranes. Bladder worm stage in vertebrates or in invertebrates. Adults in intestine of vertebrates, especially mammals.

TYPE AND ONLY FAMILY.—*Tæniidæ.*

Family TÆNIIDÆ[b] Ludwig, 1886.

FAMILY DIAGNOSIS.—Same as diagnosis of superfamily *Tænioidea.*

This family is divided into the subfamilies *Mesocestoidinæ*, *Acoleinæ*, *Amabiliinæ*, *Tetrabothriinæ*, *Anoplocephalinæ*, *Dipylidiinæ*, *Davaineinæ*, and *Tæniinæ;* three of these (*Dipylidiinæ*, *Davaineinæ*, and *Tæniinæ*, for key see p. 11) are represented among the parasites of man.

Subfamily TÆNIINÆ[c] Stiles, 1896.

SUBFAMILY DIAGNOSIS.—*Tæniidæ:* Usually large species; gravid segments usually considerably longer than broad. Scolex with rostellum and usually with double row

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[a] SYNONYM.—*Cyclophyllidea.*

[b] SYNONYM.—*Tæniada.*

[c] SYNONYMS.—*Tæniea* Goldberg, 1855a; *Cystotæniæ* Claus, 1876; *Tænianæ* Railliet, 1896.

of hooks; in exceptional cases rostellum is developed into an apical sucker, the armature (hooks) becoming lost. Genital pores irregularly alternate. Testicles usually very numerous, in lateral portions of median field. Ovary, shell gland, and vitellogene gland in distal half of middle zone; uterus with median stem, which develops lateral branches; the latter afterwards suppress the genital glands. Of the four longitudinal excretory canals, usually only the ventral remain visible in the gravid segments. Egg shell thin, with or without filaments, and usually becomes destroyed; embryonal shell (embryophore) thick, radially striated.

Bladder worm stage, a cysticercus, cœnurus, or echinococcus, in herbivorous or omnivorous animals; adults in carnivorous animals.

TYPE GENUS.—*Tænia* Linnæus, 1758.

This subfamily contains two genera, represented among the parasites of man, namely, *Tænia* and *Echinococcus;* the former is represented among the intestinal parasites of man, the latter (see p. 75) among the somatic parasites of man.

Genus TÆNIA [a] Linnæus, 1758.

GENERIC DIAGNOSIS.—*Tæniinæ* (p. 23): In general, same as diagnosis of subfamily *Tæniinæ;* larval stage a cysticercus. Adults in carnivorous mammals; larval stage chiefly in herbivorous and omnivorous mammals.

TYPE SPECIES.—*Tænia solium* Linnæus, 1758.

This genus is divided into several subgenera, which some authors have recognized, not entirely without reason, as entitled to full generic rank. These subgenera—or, if one prefers, genera—may be distinguished as follows:

KEY TO THE SUBGENERA (OR GENERA) OF TÆNIA.

(For forms reported for man follow roman type.)

1. Segments always more than 10, usually more than 100; lateral uterine branches distinct; vitellogene gland triangular, with one side parallel to posterior margin of segment; larval stage never forms brood capsules 2

Strobilla composed of head and three segments, only one of which is gravid at a time; lateral uterine branches often quite indistinct; vitellogene gland globular; larval stage an echinococcus, which forms brood capsules inside of which the scolices develop............. *Echinococcus* (p. 75)

2. Head with distinct rostellum armed with double crown of hooks.......... 3

Rostellum rudimentary; hooks small and become lost very early, so that head appears unarmed, the crown of hooks being replaced by a structure known as the "apical" or "fifth" sucker; larva a cysticercus.. *Tæniarhynchus* (p. 26)

3. Larva a cysticercus, namely, a small bladder worm with one scolex. *Tænia* (p. 36)

Larva a cœnurus, namely, a bladder worm with numerous heads, but without brood capsules .... Multiceps. [b]

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[a] SYNONYMS.—See synonymy of subgenera *Tænia*, p. 36, and *Tæniarhynchus*, p. 26.

[b] Not represented among the parasites of man. *Multiceps* Gœze, 1782; *Polycephalus* Zeder, 1800; *Cœnurus* Rupolphi, 1808; *Polycephops* Rafinesque, 1815; *Cænurus* Cuvier, 1825a; *Canurus* Goodsir, 1844g.

All of the forms found in man are usually referred to simply as members of the genus *Tænia*, as *Tænia solium*, *Tænia saginata*, etc.

Difficulty is occasionally experienced by physicians in determining tapeworms when they have only a part of the parasite for examination. To meet the difficulties which thus arise, the following key is prepared:

KEY TO THE SPECIES[a] OF TÆNIA FOUND IN MAN.

(For species known to occur in man in the United States, follow roman type.)

1. Strobila 2
Head 3
Segments 7
Mature segments (namely, with genital glands) 8
Gravid segments (namely, with eggs) 12
Source of infection 15

2. Strobila attains:
2 to 3.5, rarely 6 to 8 meters in length; head armed; cosmopolitan .... *T. solium* (p. 37)
4 to 10 meters in length (*T. saginata* and *T. confusa*) 1
1.4 meters in length; head unarmed; Africa .... *T. africana* (p. 32)
unknown length; original immature specimen measured 70 mm. long; head unarmed; Asiatic Russia .... *T. hominis* (p. 36)
0.5 to 2 meters in length; head armed .... *T. pisiformis* (p. 41)
0.15 to 0.6 meters in length; head armed .... *T. teniæformis* (p. 43)

3. Head:
armed with hooks (subgenus *Tænia*) 4
unarmed (subgenus *Tæniarhynchus*) 5
unknown; see also 1 .... *T. confusa* (p. 44)

4. Rostellum:
short, armed with 24 to 32 hooks; see also 2 .... *T. solium* (p. 37)
rather powerful, armed with 34 to 48 hooks; see also 2 .... *T. pisiformis* (p. 41)
very prominent, armed with 26 to 52 hooks; see also 2 .... *T. teniæformis* (p. 43)

5. *A circular ring surrounds head back of suckers, which are directed postero-anteriorly; Asiatic Russia* .... *T. hominis* (p. 36)
No such circular ring present 6

6. Head rather cuboid, 1.5 to 2 mm. in diameter; suckers 0.7 to 0.8 mm. in diameter .... *T. saginata* (p. 27)
Head rather small, 1.38 mm. broad, 1.03 mm. thick, 0.47 mm. long; suckers 0.63 mm. in diameter; Africa .... *T. africana* (p. 32)

7. Segments:
become longer than broad (*T. solium, T. pisiformis, T. crassicollis, T. saginata, T. confusa*) 1
become longer than broad only in last 100 proglottids .... *T. saginata* (p. 27)
become longer than broad in last half of worm .... *T. solium* (p. 37)
are longer than broad in nearly entire worm .... *T. confusa* (p. 44)
always broader than long; Africa; see 1 .... *T. africana* (p. 32)
unknown; Asiatic Russia; see 1 .... *T. hominis* (p. 36)

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[a] *T. pisiformis* and *T. teniæformis* are included in this table, although there are doubts regarding their occurrence in man.

8. Mature segments measure:
2.5 to 3 mm. long, 4.5 to 5 mm. broad (*T. solium*) 9
4 to 4.5 mm. long, 3.5 to 4.5 mm. broad (*T. confusa*)................ 9
4 to 6 mm. long, 8 to 10 mm. broad (*T. saginata*) .... [illegible]
2 mm. long by 7 mm. broad (T. africana)............................ 9
unknown; Asiatic Russia (T. hominis)................................ 3

9. Ovary divided into 2 portions, right and left of median line.............. 10
Ovary divided into 3 portions, 2 being on pore side of the segment....... *T. solium* (p. 37)

10. Ovaries in distal half of segment.................................... 11
Ovaries fan-shaped, composed of club-shaped tubes centering toward the shell gland, and occupying the 2nd and 3rd transverse fourths of segment; Africa. *T. africana* (p. 32)

11. Ovarian lobes:
round; testicles 0.15 mm. in diameter..................*T. saginata* (p. 27)
reniform; testicles 0.089 to 0.096 mm. in diameter.........*T. confusa* (p. 44)

12. Gravid segments (as passed from anus):
longer than broad; uterine branches more or less dichotomous....... 13
broader than long; 15 to 24 simple lateral uterine branches; Africa .... *T. africana* (p. 32)

13. Gravid segments 27 to 35 mm. long, 3.5 to 5 mm. broad; uterus with 14 to 18 short, thick, lateral branches each side.............*T. confusa* (p. 44)
Gravid segments less than 26 mm. long 14

14. Gravid segments:
12 to 20, rarely to 25, mm. long by 4 to 7 mm. broad; uterus with 15 to 30 slender uterine branches each side of median stem....*T. saginata* (p. 27)
10 to 12 mm. long, 5 mm. broad; uterus with 7 to 14 short, thick, uterine branches each side of median stem..............*T. solium* (p. 37)
10 to 17 mm. long, 4 to 6 mm. broad; uterus with 8 to 10 uterine branches each side of median stem.............................*T. pisiformis* (p. 41)
8 to 10 mm. long, 5 to 6 mm. broad; uterus with about 12 uterine branches each side of median stem ....*T. teniæformis* (p. 43)

15. Cysticercus, known as:
Cysticercus bovis, lives in cattle........................*T. saginata* (p. 27)
C. cellulosæ, lives in swine...............................*T. solium* (p. 37)
C. pisiformis, lives in rabbits.........................*T. pisiformis* (p. 41)
C. fasciolaris, lives in rats and mice ....*T. teniæformis* (p. 43)
unknown...*T. confusa* (p. 44)
unknown.........................*T. africana* (p. 32), *T. hominis* (p. 36)

Subgenus TÆNIARHYNCHUS[a] Weinland, 1858.

SUBGENERIC DIAGNOSIS.—*Tænia* (p. 24): Rostellum rudimentary; hooks small and disappearing early. Otherwise like *Tænia* (*Tænia*); see p. 36.

TYPE SPECIES.—*Tænia saginata* (Gœze, 1782).

Of the 3 species of this subgenus reported for man, only one (namely, *T. saginata*) is of any importance to physicians practicing in the United States.

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[a] SYNONYMS.—*Pentastoma* Virey, 1823, not Rudolphi, 1819a; *Tæniarhynchus* Weinland, 1858.

The Fat Tapeworm—TÆNIA SAGINATA[a] Gœze, 1782.

[Figs. 28 to 34.]

SPECIFIC DIAGNOSIS.—*Tænia* (*Tæniarhynchus*) (p. 26): Strobila attains 4 to 8 or 10 meters in length, greatest breadth 12 to 14 mm.; composed of about 1,300 segments. Head rather cuboid, 1.5 mm. to 2 mm. in diameter; rostellum very rudimentary, replaced by apical sucker-like structure 0.114 mm. in diameter; suckers 0.7 to 0.8 mm. in diameter, lumen 0.47 mm. Unsegmented neck present. Genital pore back of middle of lateral margin, genital cloaca 0.22 mm. deep, funnel-shaped. Sexually mature proglottids measure 4 to 6 mm. long, 8 to 10 mm. broad; vagina with or without setæ; ovary divided into two round lobes which lie distally of a transverse plane passing through genital pore; testicles 0.15 mm. in diameter; seminal vesicle absent; length of cirrus pouch 0.4 to 0.5 mm. Gravid (terminal) proglottids attain 12 to 20, rarely 25 mm. long, by 4 to 6.5 mm. broad; uterus with 15 to 35 dichotomous branches each side of and shorter than median stem. Calcareous corpuscles plentiful, attain 18 μ. Eggs globular, outer eggshell bears one or two filaments; embryophore thick, oval, transparent to dark brown, 30 to 40 μ long, 20 to 30 μ broad.

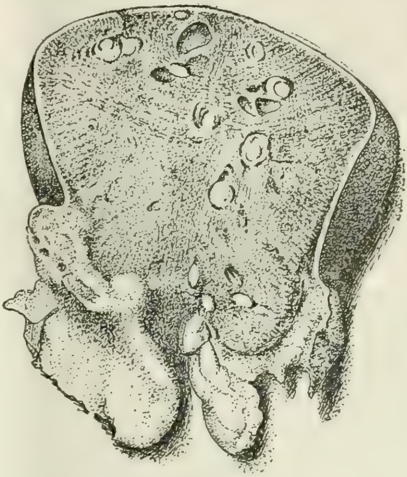

FIG. 28.—Section of a beef tongue heavily infested with beef measles, natural size. (After Stiles, 1898a, 72, fig. 68.)

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[a] SYNONYMS.—*Tænia solium* Linnæus, 1758a, pro parte; *T. cucurbitina* Pallas, 1766, pro parte; *T. cucurbitina saginata* Gœze, 1782a; *T. cucurbitina grandis saginata* Gœze, 1782a; ?*T. vulgaris* Werner, 1782 (not Linnæus, 1758a), renamed *T. dentata* Batsch, 1786a (not Nicolai, 1830); ?*T. solitaria* Leske, 1784 or 1785, pro parte (not accessible); *T. grandis* Gmelin, 1790a; *Halysis solium* (Linnæus, 1758) Zeder, 1803a, pro parte; *Pentastoma coarctata* Virey, 1823; *Tænia dentata* Nicolai, 1830; ?*T. fenestrata* delle Chiaje, 1833a; *T. lata* Pruner, 1847 (not Linnæus, 1758a); *T. tenella* Pruner, 1847 (not Pallas, 1781); *Bothriocephalus tropicus* Schmidtmueller, 1847; *Tænia mediocanellata* Kuechenmeister, 1852f; *T. mediocanellata hominis* Kuechenmeister, 1852f; *T. zittaviensis* Kuechenmeister, 1852f; *T. solium mediocanellata* of Diesing, 1854b; *T.* [*Tæniarhynchus*] *mediocanellata* Kuechenmeister of Weinland, 1858; *T. solium abietina* Weinland, 1858; *T. inermis* Moquin-Tandon, 1860, and Laboulbène, 1876 (not Brera, 1803a); *T. tropica* (Schmidtmueller, 1847), Moquin-Tandon, 1860; "*T. mediocanellata* of several authors," Moquin-Tandon, 1860; *T. capensis* Moquin-Tandon, 1860; *Tæniarhynchus mediocanellatus* (Kuechenmeister, 1852) Weinland, 1861; *Tænia megaloon* Weinland, 1861; *T.* [(*Cystotænia*)] *mediocanellata* of Leuckart, 1863; *T. lophosoma* Cobbold, 1866; *T. saginata* Gœze, 1782, of Leuckart, 1867; *T. abietina* Weinland, 1858, of Davaine, 1873a; ?*T. fusa* Colin, 1876a; ?*T. continua* Colin, 1876a; ?*T. solium fusa* Colin, 1876a; ?*T. solium continua* Colin, 1876a; *T. nigra* Davaine, 1877a; *T. algérien* Redon, 1883; *Tenia abietina* (Weinland, 1858) Guzzardi Asmundo, 1885a; *T. mediocanellata* (Kuechenmeister) Guzzardi Asmundo, 1885a; *Tænia mummificata* Guzzardi Asmundo, 1885a; *Tenia cosidetta mummificata* Guzzardi Asmundo, 1885a; *Tænia saginata abietina* Weinland of Leuckart (Hoyle), 1886; *Tenia seghettata* Bergonzini, 1886a;

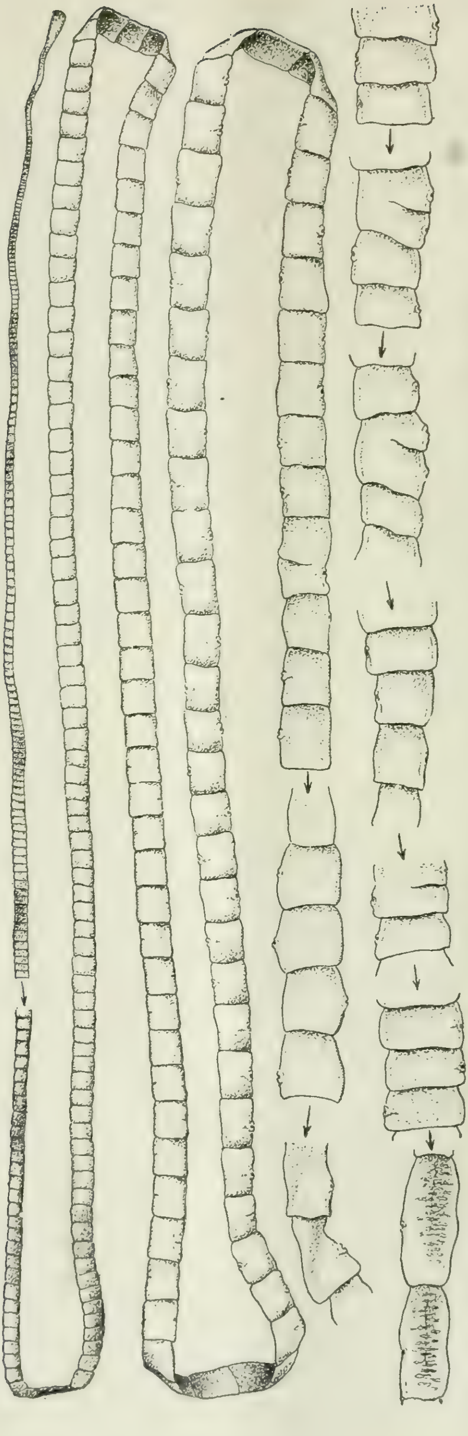
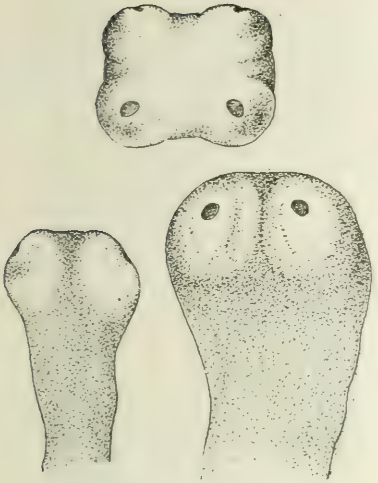


FIG. 29.—Several portions of an adult beef measle tapeworm (*Tænia saginata*) from man, showing the head on the anterior end and the gradual increase in the size of the segments, natural size. (After Stiles, '98a, 73, fig. 69.)



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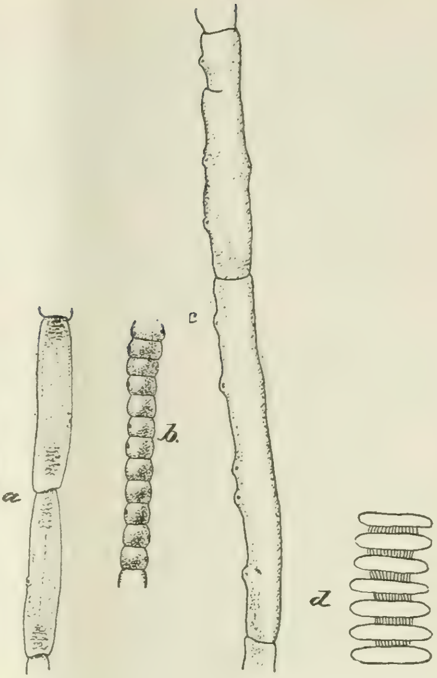

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FIG. 30.—Dorsal, apex, and lateral views of the head of beef-measle tapeworm (*Tænia saginata*), showing a depression in the center of the apex. × 17. (After Stiles, 1898a, 74, fig. 70.)

FIG. 31.—Segments from various strobilæ of beef-measle tapeworm (*Tænia saginata*), showing forms of proglottids which are occasionally found: *a*, elongated segments; *b*, bead-like segments; *c*, a portion of the strobila in which the segmentation is not distinct; *d*, moniliform segments (*a* and *b* after Stiles, 1898a, 75, fig. 71; *c* and *d* after Blanchard, 1894).

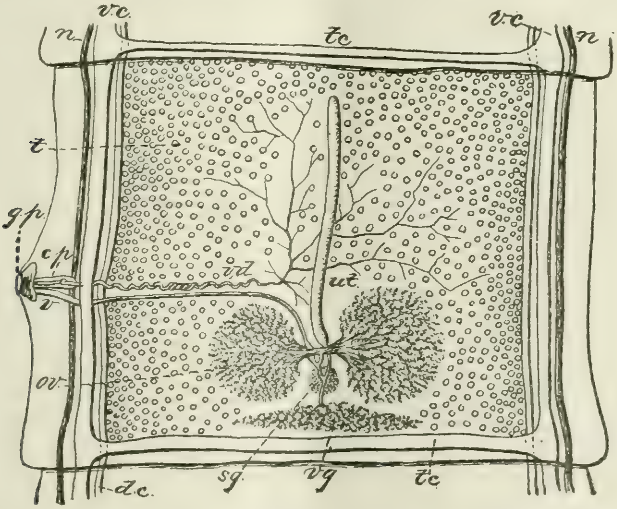


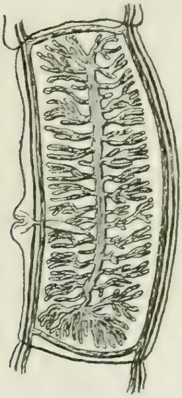
FIG. 32.—Sexually mature segment of beef-measle tapeworm (*Tænia saginata*): *c. p.*, cirrus pouch, with cirrus; *d. c.*, dorsal canal; *g. p.*, genital pore; *n.*, lateral longitudinal nerves; *ov.*, ovary; *s. g.*, shell glands; *t.*, testicles; *ut.*, median uterine stem; *v.*, vagina; *v. c.*, ventral canals connected by transverse canal, *t. c.*; *v. d.*, vas deferens; *v. g.*, vitellogene gland. Enlarged. (After Leuckart and Stiles.)

Cysticercus: *Cysticercus bovis*,[a] spherical to elliptical 7.5 to 10 mm. long by 3 to 5.5 mm. broad, whitish to gray with small yellow spot due to the invaginated head; no hooks present; the bladder contains but little fluid. This stage requires about 3 to 6 weeks for its development from the onchosphere.

HABITAT.—Adult known only for man. Cysticercus found in muscles, especially tongue and masseters, of cattle (*Bos taurus*); also reported for Rocky Mountain "antelope" (*Antilocapra americana*), giraffe (*Giraffa camelopardalis*), and lama (*Auchenia llama*).

GEOGRAPHIC DISTRIBUTION.—More or less cosmopolitan.

SPECIAL MEDICAL SIGNIFICANCE.—The most common of the large tapeworms, except in certain districts where the broad tapeworm abounds. It is not so dangerous as *T. solium*, as there is no danger of autoinfection with *cysticercosis* (see p. 68); anemia is more likely to develop with this species than with *T. solium*, but less likely than with *Dibothriocephalus latus*; it is more difficult to expell than are the other large species.



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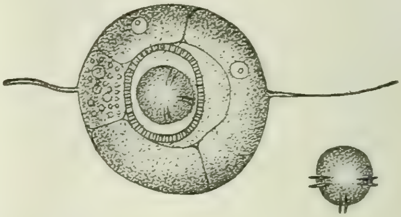

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FIG. 33.—Gravid segment of beef-measle tapeworm (*Tænia saginata*), showing lateral branches of the uterus. Enlarged. (After Stiles, 1898a, 77, fig. 73.)

FIG. 34.—Egg of beef-measle tapeworm (*Tænia saginata*), with thick eggshell (embryophore), containing the six-hooked embryo (onchosphere), enlarged. (After Leuckart.)

PREVENTION.—Meat inspection; cooking of beef, especially of tongue and masseter muscles; cold storage of beef for 21 days after killing. A person with this tapeworm should never defecate in fields used for pasturing cattle.

SUBSPECIES AND VARIATIONS.—Occasionally variations, monstrosities, and pathological specimens of this species have been found and

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Tænia inermis fenestrata Maggiora, 1891; *T. perforata* Maggiora, 1891; *T. algeriana* Pepper, 1894; *T. algeriensis* Braun, 1894a.

BIBLIOGRAPHY.—For zoological discussion see Leuckart, 1880, 513–616, figs. 237–273; for medical literature see Stiles & Hassall, Index-Catalogue of Medical and Veterinary Zoology.

[a] SYNONYMS.—*Cysticercus tæniæ mediocanellatæ* Leuckart, 1863; *C. bovis* Cobbold, 1866a; *C. inermis* Davaine, 1877a; *C. tæniæ saginatæ* Leuckart, 1880; *C. "cellulosæ"* Ward, 1895; *Cysticerkus bovis* (Cobbold, 1866) Schneidemuehl, 1896; *Cysticerkus tæniæ saginatæ* (Leuckart) Schneidemuehl, 1896,

described as distinct species. One of these forms (*Tænia saginata abietina*) is of special interest to American physicians in so far that the only specimen ever taken was collected from an Indian in this country. It was first described as a variety of *Tænia solium*, but part of the original material has been reexamined, both by Leuckart and myself, and the characters found indicate that it is more closely related to *Tænia saginata*. Owing to the small amount and poor condition of the original material it is difficult to pass judgment upon the form; without further specimens, I should view it as a dwarfed specimen of *Tænia saginata*, but in order to direct special attention to it, in the hope that further specimens may be found, it is here accepted as a special form, leaving open the question as to whether it represents simply a variation, a variety, or a subspecies. One would scarcely be justified, at least at present, in giving it specific rank.

Weinland's Chippewa Tapeworm—TÆNIA SAGINATA ABIETINA[a] (Weinland, 1858) Leuckart, 1886.

[Figs. 35 to 38.]

SUBSPECIFIC DIAGNOSIS.—*Tænia* (*Tæniarhynchus*) *saginata:* Length of strobila unknown; fragment measured "several feet in length." Head, neck, and mature segments unknown, but from resemblance of uterus to that of *T. saginata* the head is assumed to be unarmed. Gravid segments very thin, nearly transparent, equally narrow, attain 12 mm. long by 4 mm. broad; calcareous corpuscles very numerous, round to oval, may attain 17.6 μ; genital pore very small, about $\frac{5}{8}$ of length of segment from anterior margin; uterus with straight median stem and 30 to 40 lateral branches each side, generally straight, "never arborescently divided nor furcated at the ends, with the exception of the foremost and hindmost in each joint, which run, the former forward, the latter backward, both being forked and crooked." Eggs 31 to 37.5 by 30 to 33.9 μ.

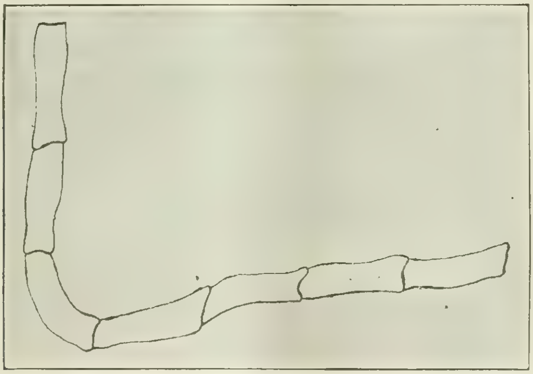

FIG. 35.—Strobila of *Tænia saginata abietina*. Natural size. (After Weinland, 1861, fig. 18.)

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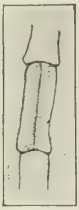
[a] SYNONYMS.—*Tænia solium abietina* Weinland, 1858; *T. abietina* Weinland, 1858, of Davaine, 1873a; *Tenia abietina* (Weinland, 1858) Guzzardi Asmundo, 1885a; *Tænia saginata abietina* (Weinland, 1858) Leuckart (Hoyle), 1886.

Habitat.—Intestine of man at Sault Ste. Marie, Lake Superior. Type, no. 9713 U. S. P. H. & M. H. S.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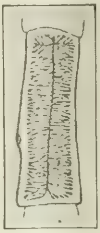
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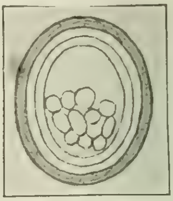
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Fig. 36.—Segment of same showing the uterus. Natural size. (After Weinland, 1861, fig. 19.)
Fig. 37.—Gravid segment. ×2. (After Leuckart, 1863, 289, fig. 80.)
Fig. 38.—Egg of same. Greatly enlarged. (After Weinland, 1861, fig. 20.)

The African Tapeworm—TÆNIA AFRICANA Linstow, 1900.

[Figs. 39 to 51.]

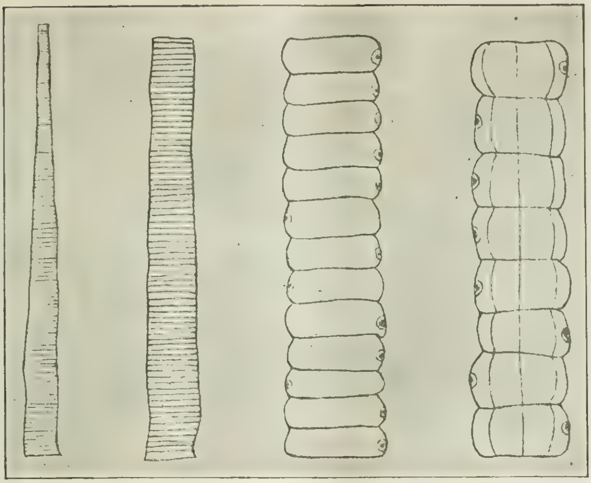
Specific diagnosis.—*Tænia* (*Tæniarhynchus*) (p. 26): Strobila attains 1.4 meters in length and is composed of about 600 segments. Scolex unarmed, very small, 1.38 mm. broad, 1.03 mm. thick, 0.47 mm. long. Suckers circular, 0.63 mm., lumen 88 μ; "apical sucker" 0.16 mm. Segments all broader than long, as follows: Immediately back of head, 0.16 mm. long by 1.78 mm. broad by 0.59 mm. thick; anterior segments, 1 by 5 by 0.75; 2 by 7 by 1.06; in middle of worm, 3 by 9 by 1.20; terminal segments, 7 by 12 to 15 by 1.35. Segments, about 150th segment from head and 2 mm. long, are mature; segments 7 mm. long are gravid. Cortical layers to middle layer in the proportion of 11:8:11. Ventral canals 0.43 to 0.82 mm. in diameter, their center bearing the relation of 14:72:14 to the transverse diameter of the segment; transverse canals with diameter $\frac{1}{3}$ as great as the dorso-ventral diameter of the segment. Three longitudinal nerves, close to and lateral of ventral canals, the center nerve crescentic on cross-section, 0.14 mm. broad, the smaller nerves 70 μ broad. Calcareous corpuscles oval, concentric, 10.4 by 16.9 μ, lacking in anterior and mature segments, but present in gravid segments, and numerous in terminal proglottids. Genital pores irregularly alternate in equator of segment; genital sinus funnel shaped. *Male* organs: Testicles numerous, scattered throughout middle layer, 88 to 114 μ, or 70 to 53 μ; vas deferens very convoluted, extending [illegible]ths across the segment; thickly setose cirrus 52 μ broad, makes a loop in the cirrus pouch; cirrus pouch pyriform, with thick wall. *Female* organs: Ovary composed of two fan-shaped wings, composed of club-shaped tubes centering toward the shell-gland, occupies the 2nd and 3rd transverse fourths of the segment, and leaves but a narrow proximal and distal margin of the segment free; vitellogene gland distal, 1.70 mm. broad by 79 μ long; shell-gland median, globular, 0.21 to 0.23 mm.; vagina setose, 35 μ broad, runs almost straight from vulva to the shell-gland, near which it widens into a 0.17 by 0.07 mm. receptaculum seminis; on each side of median uterine stem, 15 to 24 lateral unbranched pouches, which are longer than median stem and spread out like a fan. Embryophore 31 to 39 by 33.8 μ, with thick radially-striated shell; hooks of onchosphere, 7.8 μ long.

Cysticercus: Unknown.

Habitat. Adult in intestine of man. Suspicion has fallen on the zebu as possibly being the intermediate host.

Geographic distribution. Known only for Langenburg, German East Africa.

Medical significance.—Unknown.



Figs. 39 to 42.—Four portions of strobila of *Tænia africana*. (After Linstow, 1900, 487, figs. 1-4.)

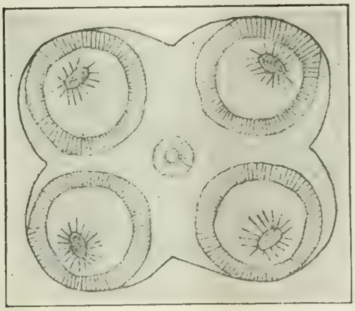


Fig. 43.—Apex view of head of same. Greatly enlarged. (After Linstow, 1900, 487, fig. 5.)

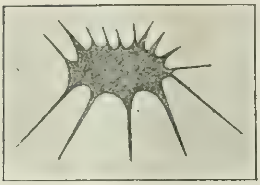


Fig. 44.—Lumen of sucker. Greatly enlarged. (After Linstow, 1900, 487, fig. 6.)

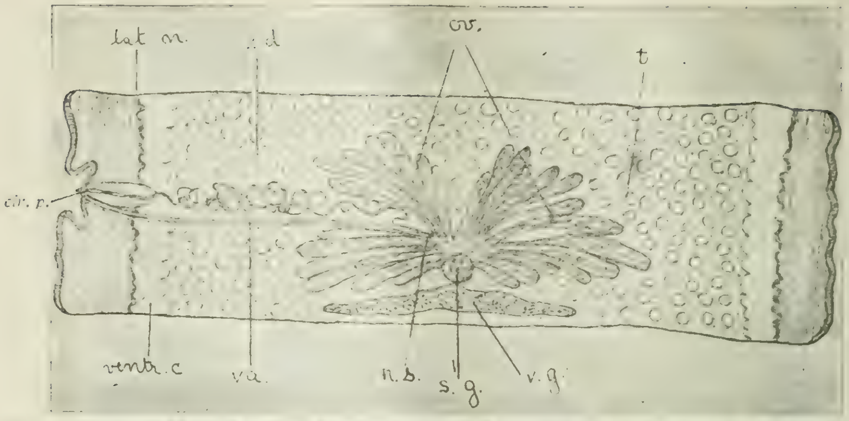


FIG. 45.—Diagram of frontal section of mature segment of same, to show the anatomy: *cir. p.*, cirrus pouch; *lat. n.*, latéral nerve; *ov.*, ovary; *r. s.*, receptaculum seminis; *s. g.*, shell gland; *t.*, testicles; *va.*, vagina; *ventr. c.*, ventral canal; *v. d.*, vas deferens; *v. g.*, vitellogene gland. Enlarged. (After Linstow, 1900, 488, fig. 7.)

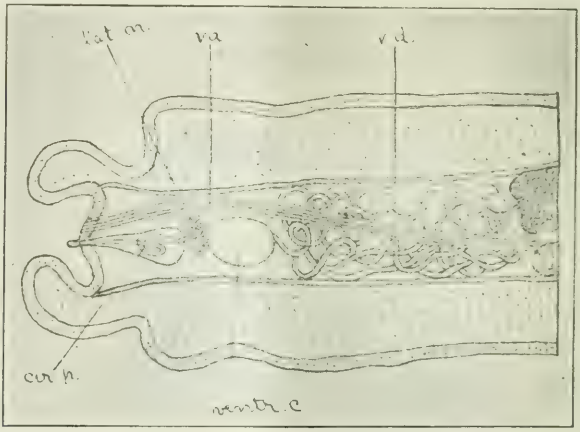


FIG. 46.—Transverse section of marginal portion of segment; same lettering as in fig. 45. (After Linstow, 1900, 488, fig. 8.)

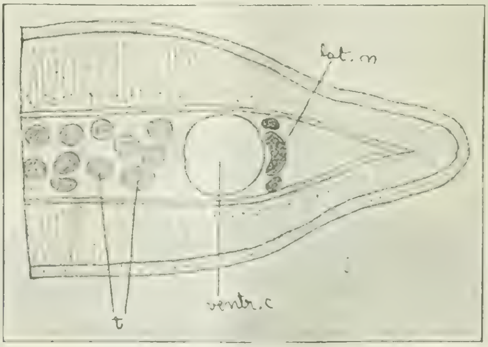
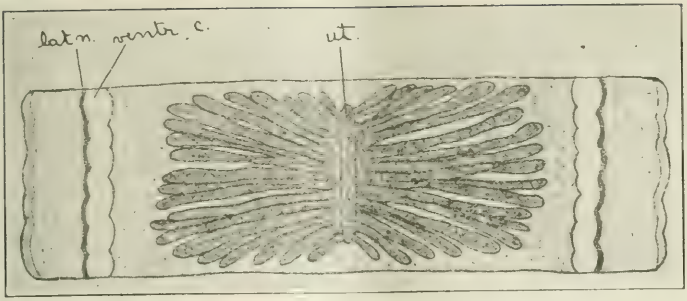
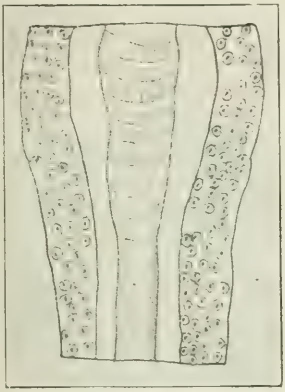


FIG. 47.—Transverse section of marginal portion of segment at another point; same lettering as in fig. 45. (After Linstow, 1900, 488, fig. 9.)





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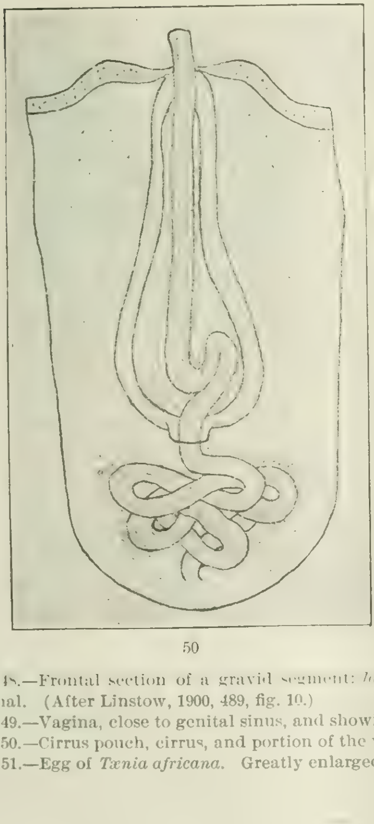

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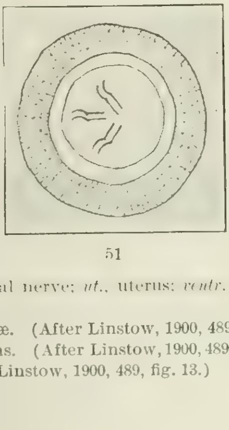

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FIG. 48.—Frontal section of a gravid segment: *lat. n.*, lateral nerve; *ut.*, uterus; *ventr. c.*, ventral canal. (After Linstow, 1900, 489, fig. 10.)

FIG. 49.—Vagina, close to genital sinus, and showing the setæ. (After Linstow, 1900, 489, fig. 11.)

FIG. 50.—Cirrus pouch, cirrus, and portion of the vas deferens. (After Linstow, 1900, 489, fig. 12.)

FIG. 51.—Egg of *Tænia africana*. Greatly enlarged. (After Linstow, 1900, 489, fig. 13.)

TÆNIA HOMINIS[a] Linstow, 1902.

[Figs. 52 to 53.]

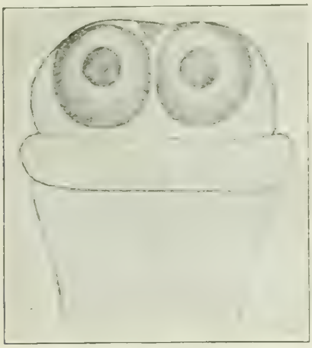
Specific diagnosis.—*Tænia* (*Tæniarhynchus*) (p. 26): Strobila 70 mm. long; back of scolex it is 1.11 mm. broad, posteriorly 1.97 mm. Scolex 2.01 mm. broad by 1.34 mm. long. Rostellum unarmed, rudimentary, 240 μ broad, 75 μ long. Suckers with lumena (0.60 mm. deep) running postero-anteriorly, so that they are circular on cross section. Genital organs not developed in specimen examined. Back of suckers a circular ridge. Possibly strobila grows as large as *T. saginata*. Dorsal and ventral cortical layer as broad as inner layer. Calcareous corpuscles very numerous, arranged in concentric layers. No black pigment present in type specimen. Ventral canals 16 μ lateral of dorsal canals; the ventral canals run in the 2d and 5th sixths of lateral diameter, and are connected with transverse canals at distal border of each segment; dorsal canals surrounded by radially running muscles. Longitudinal nerve closely lateral of ventral canals.

Cysticercus: Unknown.

Habitat.—Adult in intestine of man.

Geographic distribution.—Known only for Aschabad, Asiatic Russia.

Medical significance.—Unknown.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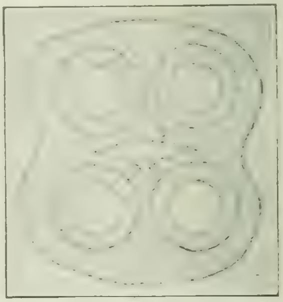
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Fig. 52.—Head of *Tænia hominis*; note the circular ridge back of the suckers. Greatly enlarged. (After Linstow, 1902, 770, fig. 3.)

Fig. 53.—Transverse section of same, through the suckers. (After Linstow, 1902, 770, fig. 4.)

Subgenus TÆNIA.[b]

Subgeneric Diagnosis.—*Tænia* (p. 24): Rostellum distinct, and armed with a double crown of hooks of two sizes; segments usually numerous, may be over 500

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[a] Synonym.—*Tænia hominis* Linstow, 1902 (not *T. armata hominis* Brera, 1808a; not *Tænia lata hominis* Bloch, 1782a; not *Tænia albopunctata hominis* Diesing, 1850a; not *Tænia mediocanellata hominis* Kuechenmeister, 1852f).

[b] Synonyms.—*Tænia* Linnaeus, 1758a; *Tænia* Scopoli, 1777; *Hydatigena* Goeze, 1782a; *Megocephalos* Goeze, 1782a; ? *Pseudoechinorhynchus* Goeze, 1782a; *Finna* Werner, 1786, and Brera, 1809a; *Vesicaria* Mueller, 1787, and Schrank, 1788; *Hydatula* Abildgaard, 1790a; ? *Hæruca* Gmelin, 1790a; *Hydatis* Blumenbach, 1797; *Cysticercus* Zeder, 1800a; *Alyselminthus* Zeder, 1800a; *Halysis* Zeder, 1803a; *Cisticercus* Rudolphi, 1805; *Physchiosoma* Brera, 1809a; *Finna* Brera, 1809a; *Gaziana* Rudolphi, 1810a; *Hydatigera* Lamarck, 1816; *Fischiosoma* delle Chiaje, 1825a for *Physchiosoma*; *Trachelocampylus* Fredault, 1847b; *Arhynchotænia* Diesing, 1850a; *Halisis* Goldberg, 1855a; *Acanthotrias* Weinland, 1858; *Cystotænia* Leuckart, 1863; *Neotænia* Sodero, 1886; *Neotænia* Braun, 1894a; *Cysticerkus* and *Cystizerkus* of several authors

present; vitellogene gland triangular, one side parallel to posterior margin of the segment. Larva a cysticercus which lives in mammals; adults in intestine of meat-eating mammals.

TYPE SPECIES.—*Tænia solium* Linnæus, 1758.

The Pork Tapeworm—TÆNIA SOLIUM[a] Linnæus, 1758.

[Figs. 54 to 61.]

SPECIFIC DIAGNOSIS.—*Tænia* (*Tænia*) (p. 36): Strobila attains 2 to 3.5 meters or more in length, greatest breadth 7 to 8 mm.; composed of about 800 to 900 segments. Head globular, 0.6 to 1 mm. in diameter; rostellum short but prominent; hooks 22 to 32 in number, alternating large (160 to 180 μ) and small (110 to 140 μ); suckers 0.4 to 0.5 mm. in diameter. Unsegmented neck present. Genital pores irregularly alternating, slightly back of equator of segment. Sexually mature proglottids measure 2.5 to 3 mm. long by 4.5 to 5 mm. broad; vagina with setæ; part of smaller ovarian lobe (on pore side of segment) cut off by vagina, lobes transversely oval; testicles 0.12 to 0.15 mm.; seminal vesicle absent; length of cirrus pouch? Gravid (end) proglottids attain 10 to 12 mm. long by 5 mm. wide; uterus with 7 to 14 thick, lateral, dichotomous branches each side. Calcareous corpuscles sparse, attain 0.012 mm. Eggs oval or almost round, shell thin and usually destroyed; embryophore thick, yellowish to dark brown, 31 to 36 μ.

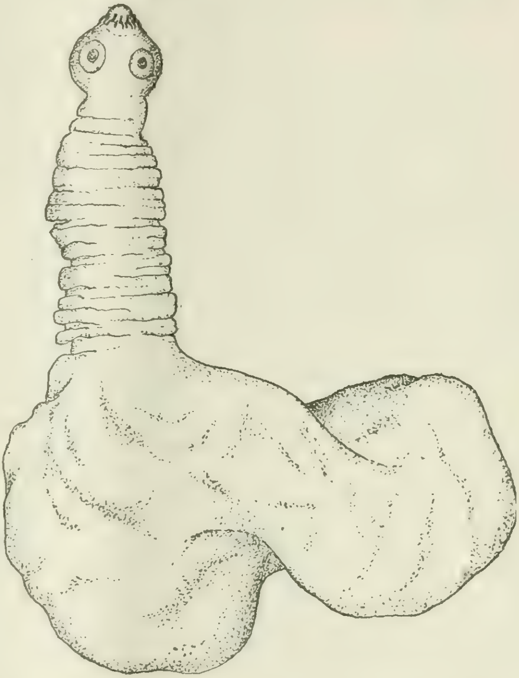

FIG. 54.—An isolated Pork-measle Bladder Worm (*Cysticercus cellulosæ*), with extended head. Greatly enlarged. (After Stiles, 1898a, 90, fig. 76.)

Cysticercus: *C. cellulosæ*,[b] ellipsoid, 6 to 10 mm. long by 5 to 10 mm. broad, with a white spot corresponding to the invaginated head; head as in adult; the bladder contains but little fluid.

HABITAT.—Adult in small intestine of man; experiments to bring about intestinal infections in swine, dogs, guinea pigs, rabbits, and apes (*Macacus cynomolgus*) have been negative. Cysticercal stage in muscles of wild boar (*Sus scrofa*) and swine (*S. scrofa domestica*); occasionally in man (*Homo sapiens*); also reported for moustached monkey (*Cercopithecus cephus*), patas guenon (*C. patas*), barbary macaque

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[a] SYNONYMS.—*Tænia solium* Linnæus, 1758a, s. str., after elimination of *T. saginata* and *T. hydatigena; T. cucurbitina* Pallas, 1766, and Bloch, 1782a; *T. cucurbitina pellucida* Gœze, 1782a; *T. cucurbitina, plana, pellucida* Gœze, 1782a; ? *T. vulgaris* Werner, 1782 (not Linnæus, 1758), renamed *T. dentata* Batsch, 1786a (not Nicolai, 1830); *T. solitaria* Leske, 1784 or 1785 (not accessible, see Seeger, 1852); *T. plana pellucida* Gœze, 1782 of Gmelin, 1790a; *Tænia armata umana* Brera, 1802a; *Halysis solium* (Linnæus, 1758) Zeder, 1803a; *Tænia armata hominis* Brera, 1808a; *T. humana armata*

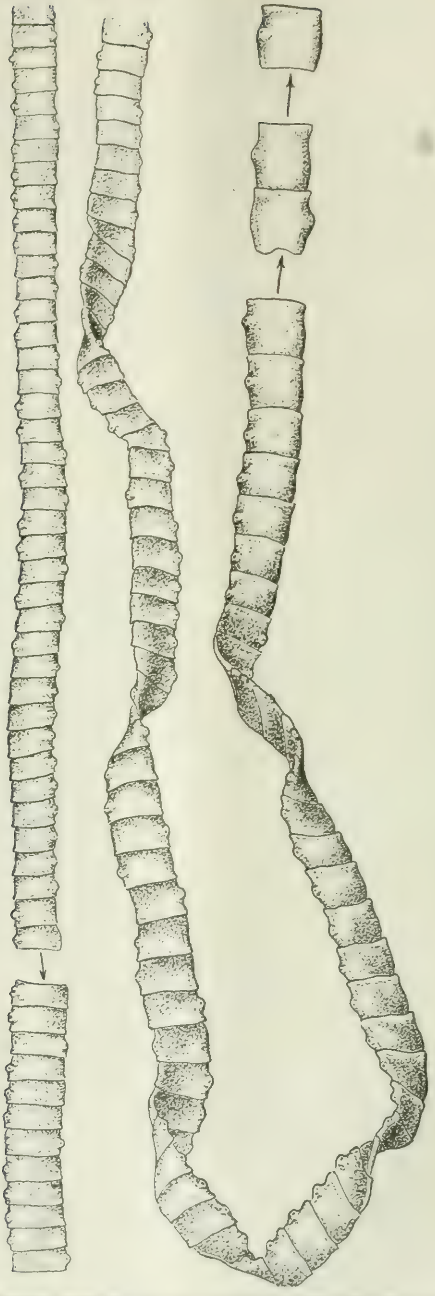


FIG. 55.—Several portions of an adult Pork-measle Tapeworm (*Tænia solium*). Natural size. (After Stiles, 1898a, 91, fig. 77.)

Rudolphi, 1810a; ? *T. fenestrata* delle Chiaje, 1833a; *T. solium* Linnaeus, 1758, partim, Kuechenmeister, 1852f; *T. hamoloculata* Kuechenmeister, 1855a; *T. turbinata* Kœberlé, 1861a; *T. melanocephala* Kœberlé, 1861a; *Tænia solium* (Linnaeus, 1758) Beneden, (*Macacus inuus*), brown bear (*Ursus arctos*), dog (*Canis familiaris*), cat (*Felis catus domestica*), black rat (*Mus rattus*), sheep (*Ovis aries*), and roe deer (*Capreolus caprea*).

GEOGRAPHIC DISTRIBUTION.—Practically cosmopolitan, following the hog.

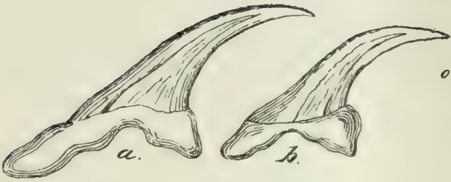
SPECIAL MEDICAL SIGNIFICANCE.—This is the most dangerous adult tapeworm of man, because of the danger of auto-reinfection leading to cysticercosis (see p. 68); hence treatment should be instituted without unnecessary delay.

PREVENTION.—Eat pork only when it is well cooked or well cured. A person with this tapeworm should never defecate in a place to which hogs have access. Box privies should never be placed near pigpens.

1861a; *T. cucurbitina* Gœze of Beneden, 1861a; *Tænia* [(*Cystotænia*)] *solium* Linnæus of Leuckart, 1863; *T.* (*Cysticercus*) *acanthotrias* (Weinland, 1858) Leuckart, 1863; *T. tenella* Cobbold, 1874v (not Pallas, 1781); *T. solium fenestrata* Colin, 1876a, and Maggiora, 1891; *T. solium minor* Guzzardi Asmundo, 1885a; *Tenia tenella* (Cobbold, 1874) Guzzardi Asmundo, 1885a; *Tænia scalariforme* Notta, 1885; *T. solium scalariforme* Notta, 1885; *T. officinalis* Bos, 1894a; *T. tenelal* Pepper, 1894.

BIBLIOGRAPHY.—For zoological discussion see Leuckart, 1880, 617–713, figs. 274–303; for medical literature see Stiles & Hassall, Index-Catalogue of Medical and Veterinary Zoology.

[b] SYNONYMS.—*Vesicaria lobata* Fabricius, 1783; *Finna* Werner, 1786; *Finna humana* Fischer in Werner & Fischer, 1786; *Tænia hydatigena* Fischer, 1788b and 1789a (not Pallas, 1766); *Hydatis piriformis* Fischer, 1789a; *Tænia cellulosæ* Gmelin, 1790a; *T. finna* Gmelin, 1790a; *Vesicaria hygroma humana* Schrank, 1793 (not accessible); *V. finna suilla* Schrank, 1793 (not accessible); *Tænia albopunctata* Treutler, 1793; *T. pyriformis* Treutler, 1793; *Hydatis finna* (Gmelin, 1790a) Blumenbach, 1797 (not accessible) and 1816a; *H. cellulosæ* (Gmelin, 1790a) Virey, 1798; *H. humana* Blumenbach,-?- (not accessible); *Tænia muscularis* Jœrdens, 1802a; *T. piriformis* Jœrdens, 1802a; *T. hydatigena anomala* Steinbuch, 1802 (not accessible); *T. cellulosa* Treutler of Zeder, 1803a; *Cysticercus albopunctatus* (Treutler, 1793) Zeder, 1803a; *C. pyriformis* (Treutler, 1793) Zeder, 1803a; *C. finna* (Gmelin, 1790) Zeder, 1803a; *Cysticercus finnus* (Gmelin, 1790) Lænnec, 1804 and 1812; *C. dicystus* Lænnec, 1804 and 1812; *C. fischerianus* Lænnec, 1804 and 1812; *Cisticercus finna* (Gmelin, 1790a) Rudolphi, 1805; *Cysticercus cellulosæ* (Gmelin, 1790a) Rudolphi, 1808a; *Fischiosoma pyriforme* (Treutler, 1793) Brera, 1809a; *Physchiosoma pyriforme* (Treutler, 1793) Brera, 1809a; *Finna cisticercus* Zeder of Brera, 1809a; *Finna muscularis* (Jœrdens, 1802) Brera, 1809a; ?*Cysticercus canis* Rudolphi, 1810a and Kœberlé, 1861a; *Tænia cellulosa* (Gmelin, 1790) Lænnec, 1812; *C. cellulosa* Lamarck, 1816; *Hydatigera cellulosa* Lamarck, 1816; *Tænia hydatigena suilla* Fischer of delle Chiaje, 1825a; *Cysticercus cellulosa* (Gmelin, 1790) Cuvier, 1825a; *Finna cysticercus* Zeder of delle Chiaje, 1825a; *Vesicaria finna* Schrank (not accessible) of delle Chiaje, 1825a; *V. hygrometra* Schrank (not accessible), of delle Chiaje, 1825a; *Hydatis lanceolata* Lam. (not accessible) of delle Chiaje, 1825a; *Tænia albopuoctata* Tschudi, 1837; *?T. hydatigena* MS. in Creplin, 1840a; *Trachelocampylus* Fredault, 1847b; *Tænia albopunctata hominis* Treutler, of Diesing, 1850a; *Vesicaria lobata suilla* Brera, of Diesing, 1850a; *Vermis vesicularis* Brera, of Diesing, 1850a; *Cysticercus cellulosa* (Gmelin, 1790) Diesing, 1850a; *?C. vesicæ hominis* Creplin, 1840, of Diesing, 1850a; *Hydatigena cellulosa* Gmelin of Diesing, 1850a; *Acanthotrias* Weinland, 1858; *Cysticercus acanthotrias* Weinland, 1858; *?C. vesicæ* Creplin, 1840, of Moquin-Tandon, 1860; *Tænia hydatigena cremita* Werner of Kœberlé, 1861a; *T. hydatigena* Kœberlé, 1861a; *Cysticercus solium* (Linnæus, 1758) Kœberlé, 1861a; *C. turbinatus* Kœberlé, 1861a; *C. melanocephalus* Kœberlé, 1861a; *C. multilocularis* Kuechenmeister, –?–; *C. suis* Cobbold, 1869; *C. racemosus* Heller, 1874a; *C. botryoides* Heller, 1874a; *Neotænia* Sodero, 1886; *Neotænia* Braun, 1894a; *Cysticercus cellulosi* Ward, 1895; *Cysticerkus cellulosæ* (Gmelin, 1790a) Schneidemuehl, 1896; *Tænia hydatigera* Fischer of Stiles, 1898.



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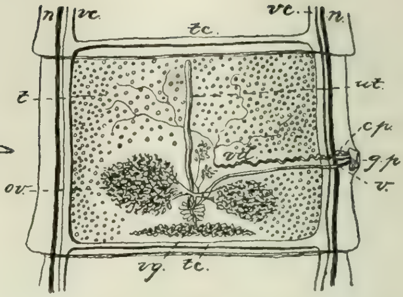

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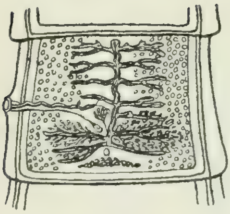
Fig. 56.—Large (*a*) and small (*b*) hooks of the Pork-measle Tapeworm (*Tænia solium*). × 280. (After Leuckart, 1880, 661, fig. 293.)

Fig. 57.—Mature sexual segments of Pork-measle Tapeworm (*Tænia solium*), showing the divided ovary on the pore side: *c. p.*, cirrus pouch; *g. p.*, genital pore, *n.*, nerve; *ov.*, ovary; *t.*, testicles; *t. c.*, transverse canal; *ut.*, uterus; *va.*, vagina; *v. c.*, ventral canal; *v. d.*, vas deferens; *v. g.*, vitellogene gland. × 10. (After Leuckart, 1880, 665, fig. 294.)



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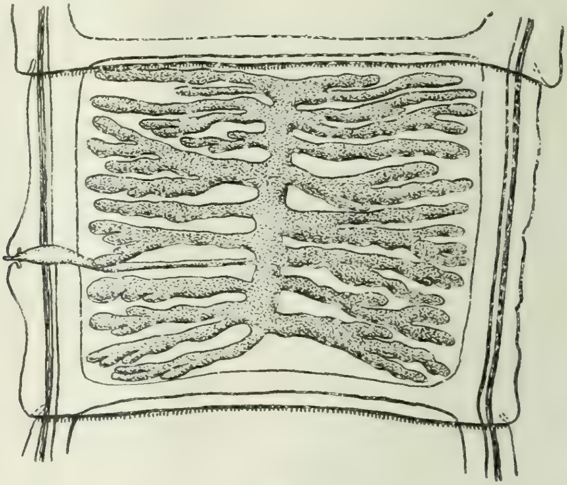

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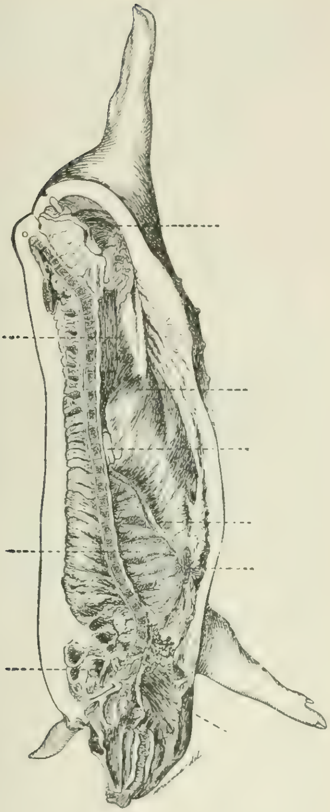
Fig. 58.—Segment of Pork-measle Tapeworm (*Tænia solium*) in which the uterus is about half developed. × 2. (After Leuckart, 1880, 666, fig. 295.)

Fig. 59.—Gravid segment of Pork-measle Tapeworm (*Tænia solium*), showing the lateral branches of the uterus, enlarged. (After Stiles, 1898a, 94, fig. 81.)



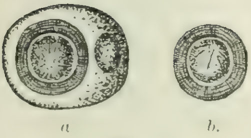


FIG. 60.—Eggs of Pork-measle Tapeworm (*Tænia solium*): *a*, with primitive vitelline membrane; *b*, without primitive vitelline membrane, but with striated embryophore. ×450. (After Leuckart, 1880, 667, fig. 297.)

FIG. 61.—Half of hog, showing the portions most likely to become infested with Pork-measles. (After Ostertag, 1895, 387, fig. 79.)

The Pisiform Tapeworm—TÆNIA PISIFORMIS[a] (Bloch, 1780) Gmelin, 1790.

[Figs. 62 to 65.]

SPECIFIC DIAGNOSIS.—*Tænia* (*Tænia*) (p. 36): Strobila attains 0.5 to 2.0 meters in length. Head, 1.5 to 2 mm. in diameter; rostellum powerful, armed with a double row of 34 to 48 hooks, alternating large (225 to 294μ) and small (132 to 177μ); ventral root of small hooks bifid. Neck, 1 to 2 mm. long, slightly narrower than head. Genital pores irregularly alternate, very prominent, giving the porose border of the segment a convexity. Segments at first narrow and much shorter than broad, becoming square about 25 cm. from the head; the straight posterior border is broader than the anterior, and thus gives the margin of the worm a serrate appearance;

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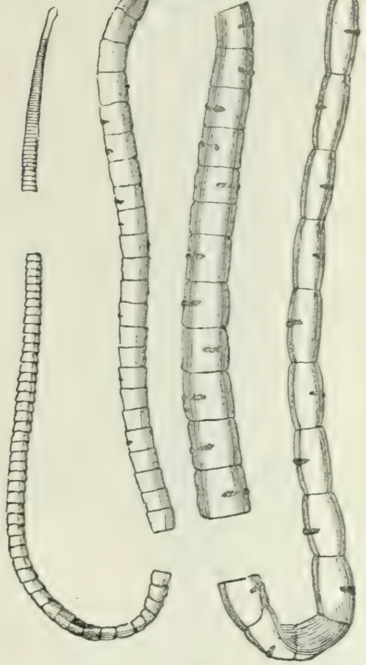
[a] SYNONYMS.—?*Tænia canina solium* Werner, 1782; ?*T. cucurbitina γ* [*canis*] Batsch, 1786a; ?*T. cucurbitina* Gmelin, 1790a; ?*T. serrata canis domestici* et *vulpis* Rudolphi, 1793a; *Tænia serrata* Gœze of Beneden, 1861a; *Tænia serrata* of most authors since Kuechenmeister.

ovaries 2, in distal half of segment. Gravid segments, 30 to 40 in number, and representing about two-fifths of the length of the worm, 4 to 6 mm. broad by 10 to 17 mm. long; uterus with 8 to 10 irregularly branched lateral pouches. Embryophores ovoid, 36 to 40 by 31 to 36μ.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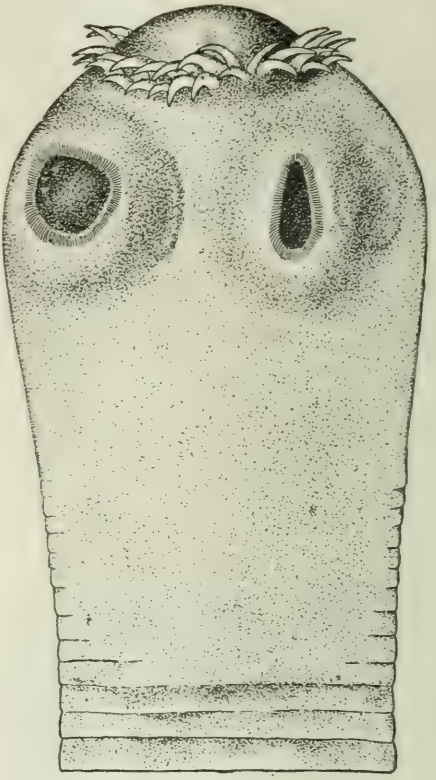
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FIG. 62.—Strobila of *Tænia pisiformis*. Natural size. (After Railliet, 1893a, 222, fig. 121.)

FIG. 63.—Head of *Tænia pisiformis*, showing hooks, suckers, and anterior segments. × 40. (After Stevenson, 1904, pl. 6, fig. 47.)

Cysticercus: *C. pisiformis*[a] first developes to about 1 cm. or more in length in the liver of rabbits, etc., then wanders to the abdominal cavity, where it becomes encysted and increases in size, becoming pisiform to elongate.

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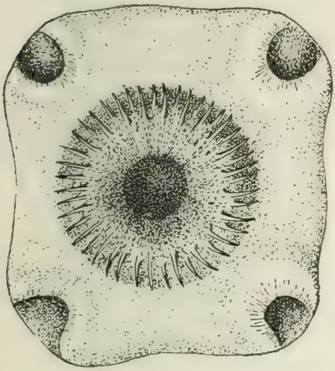
[a] SYNONYMS.—*Vermis vesicularis pisiformis* Bloch, 1780a; *Hydatigena pisiformis* (Bloch, 1780) Gœze, 1782a; *H. utriculenta* Gœze, 1782a; *H. cordata* Batsch, 1786a; *H. utricularis* Batsch, 1786a; *Vesicaris pisiformis* (Bloch, 1780a) Schrank, 1788; *V. utriculenta* (Gœze, 1782a) Schrank, 1788; *Tænia pisiformis* (Bloch, 1780a) Gmelin, 1790a; *T. utricularis* (Batsch, 1786a) Gmelin, 1790a; *T. cordata* (Batsch, 1786a) Gmelin, 1790a; ? *T. putorii* Gmelin, 1790a; *Hydatula pisiformis* (Bloch, 1782a) Frœlich, 1803a; *Cysticercus pisiformis* (Bloch, 1780a) Zeder, 1803a; ? *C. putorii* (Gmelin, 1790a) Zeder, 1803a; *C. utriculentus* (Gœze, 1782a) Lænnec, 1804; *C. lineatus pisiformis* (Bloch, 1780a) Lænnec, 1812; *Hydatis pisiformis* (Bloch, 1780a) Lamarck, 1816; *Monostoma leporis* Kuhn, 1830; ? *Cysticercus cordatus* Tschudi, 1837; *C. elongatus* Leuckart, 1842; *Monostomum leporis* (Kuhn, 1830) Diesing, 1850a; *Hydatigena hepatis murini* Diesing, 1850a; *Cysticercus serratus (pisiformis)* Kœberlé, 1861a; *C. pysiformis* Diesing of Beneden, 1861a.

HABITAT.—Adult in intestine of dogs (*Canis familiaris*) and other canines. *Cysticercus* in peritoneal cavity of rabbits (*Lepus cuniculus*), hares (*L. timidus*, *L. variabilis*), mice (*Mus musculus*), etc.

GEOGRAPHIC DISTRIBUTION.—Very extensive, probably more or less cosmopolitan.

MEDICAL SIGNIFICANCE.—Vital (1874) reports this tapeworm for man in one case in Algiers, but legitimate doubts arise regarding the correctness of his zoological determination.



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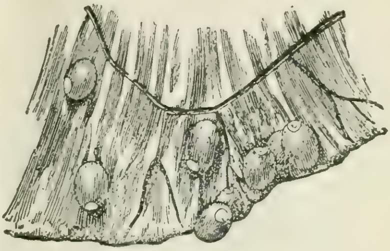

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FIG. 64.—Apex view of same. × 28. (After Stevenson, 1904, pl. 6, fig. 49.)
FIG. 65.—Portion of mesentery of rabbit infected with *Cysticercus pisiformis*. Natural size. (After Railliet, 1893a, 216, fig. 114.)

The Thick Necked Cat-Tapeworm—TÆNIA TENIÆFORMIS[a] (Bloch, 1780) Stiles & Stevenson, 1905.

[Figs. 66 to 67.]

SPECIFIC DIAGNOSIS.—Strobila attains 15 to 60 cm. in length. Head thick, cylindrical anteriorly, 1.7 mm. broad; rostellum short, armed with a double row of 26 to 52 hooks; alternating large (380 to 420 μ) and small (250 to 270 μ); suckers very prominent. Neck not distinct, as broad or broader than head. Anterior segments very short, the following cuniform, the terminal 8 to 10 mm. long by 5 to 6 mm. broad. Embryophore globular, 31 to 37 μ.

Cysticercus: *C. fasciolaris*,[b] elongate, 3 to 20 mm. long, with small terminal caudal vesicle.

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[a] SYNONYMS.—*Tænia collo brevissimo* Bloch, 1782a; *T. serrata* Gœze, 1782a; ?*T. globulata* Gœze, 1782a; ?*T. moniliformis* Batsch, 1786a, not Pallas, 1781; *T. serrata felis* Gmelin, 1790a; *T. felis* Gmelin of Carlisle, 1794a; *Alyselminthus serratus* (Gœze, 1782a) Zeder, 1800a; *Halysis serrata* (Gœze, 1782a) Zeder, 1803a; *Tænia crassicollis* Rudolphi, 1810a; *T. serrata* a, *cati domest.* b, *sylvestr.* Schrank of Rudolphi, 1810a; *Helysi serrata* (Gœze, 1782a) Rudolphi, 1810a; *Halisis serrata* (Zeder) of Goldberg, 1855a; *Tænia crassicolis* Kœberlé, 1861a.

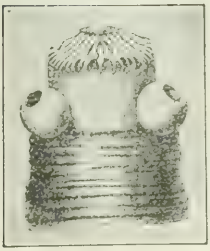
[b] SYNONYMS.—*Vermis vesicularis muris* Hartmann, 1695b; *Fasciola muris hepatica* Rœderer, 1762; *Tænia hydatigena* Pallas, 1766, in part; *T. hydatigena murini hepatis* Pallas, 1766; *Vermis vesicularis tæniaformis* Bloch, 1760a; *Fasciola* sp. Merrem, 1781; *F. saccata* Merrem of Gœze, 1782a; *Megocephalos* Gœze, 1782a, type; ?*Pseudoechinorhynchus* sp. Gœze, 1782a; *Tænia (Hydatigena) vesicularis fasciolata* Gœze, 1782a; *T. hydatigena* Werner, 1782; *T. vesicularis tæniæ formis* Bloch of Werner, 1782; *Vermis vesicularis tæniaformis* Bloch of Batsch, 1786a; *Hydatigena tæniæformis* Batsch, 1786a;

HABITAT.—Adult in small intestine of various felines, as the wild cat (*Felis catus*), domesticated cat (*F. catus domestica*), puma (*F. concolor*), etc.

Larva in liver of brown rat (*Mus decumanus*), black rat (*M. rattus*), house mouse (*M. musculus*), water vole (*Arvicola amphibius*), field vole (*A. arvalis*), long-eared bat (*Plecotus auritus*).

GEOGRAPHIC DISTRIBUTION.—Europe, Asia, North America; probably more or less cosmopolitan, following the rats.

MEDICAL SIGNIFICANCE.—Krabbe has suggested that this tapeworm may possibly occur as an occasional parasite in man, since chopped raw mice are eaten in Jütland as a folk remedy for retention of urine. I know of no case actually reported for man.



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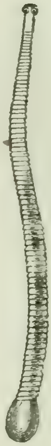

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FIG. 66.—Head of *Tænia tæniæformis*. 15. (After Neumann, in Railliet, 1893a, 250, fig. 142.)
FIG. 67.—Larval stage of *Tænia tæniæformis*. Natural size. (After Leuckart, 1880, 450, fig. 202.)

Subgenus uncertain.

Ward's Nebraskan Tapeworm—TÆNIA CONFUSA[a] Ward, 1896.

[Figs. 68 to 73.]

SPECIFIC DIAGNOSIS.—*Tænia* (subgenus uncertain) (p. 24): Strobila attains 5 to 8 mm. in length, greatest breadth 8 to 10 mm.; composed of about 750 to 800 segments. Head unknown. Neck segmented. Genital pore back of middle of lateral

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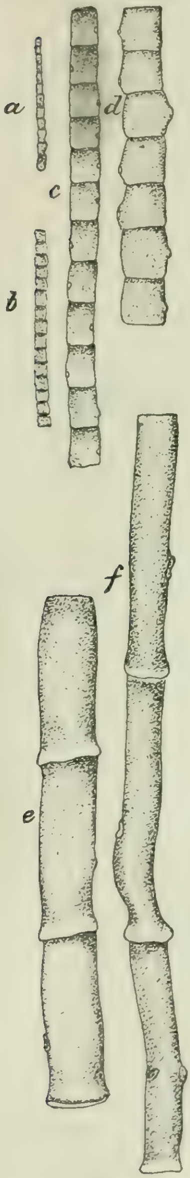
? Echinorhynchus muris Schrank, 1788; *Vesicaria tæniæformis* (Batsch, 1786a) Schrank, 1788; *? Hæruca muris* (Schrank, 1788) Gmelin, 1790a; *Tænia murina* Gmelin, 1790a, not Dujardin, 1845a; *T. hydatigena* Gmelin, 1790a; *T. vespertilionis* Gmelin, 1790a; *Vesicaria muris* Schrank, 1793; *Hydatula macrocephala hepatis musculi* Viborg, 1795; *? Echinorhynchus hæruca* Lamarck, 1801; *? E. hærucæ* Bosc, 1802; *Cysticercus tæniæformis* (Batsch, 1786a) Zeder, 1803a; *C. fasciolaris* Rudolphi, 1808a; *Hydatis murina* Bosc of Laennec, 1812; *H. hydatigena* Bosc of Laennec, 1812; *Tænia vesicularis fasciolata* Goeze of Lamarck, 1816; *Hydatigera fasciolaris* (Rudolphi, 1808a) Lamarck, 1816; *Hydatigena fasciolaris* (Rudolphi, 1808a) Diesing, 1850a; *Hydatigena hepatis murini* Goeze of Diesing, 1850a; *Cysticercus crassicolis* (*fasciolaris*) Kœberlé, 1861a.

[a] BIBLIOGRAPHY.—For zoological discussion see Guyer, 1898a, 469–492, figs. 1–11.

margin; genital cloaca 0.05 to 0.08 mm. deep. Sexually mature segments measure 4 to 4.5 mm. long, 3 to 4.5 mm. broad; setæ in vagina doubtful; ovary divided into two kidney-shaped lobes which lie distally of a transverse plane passing through



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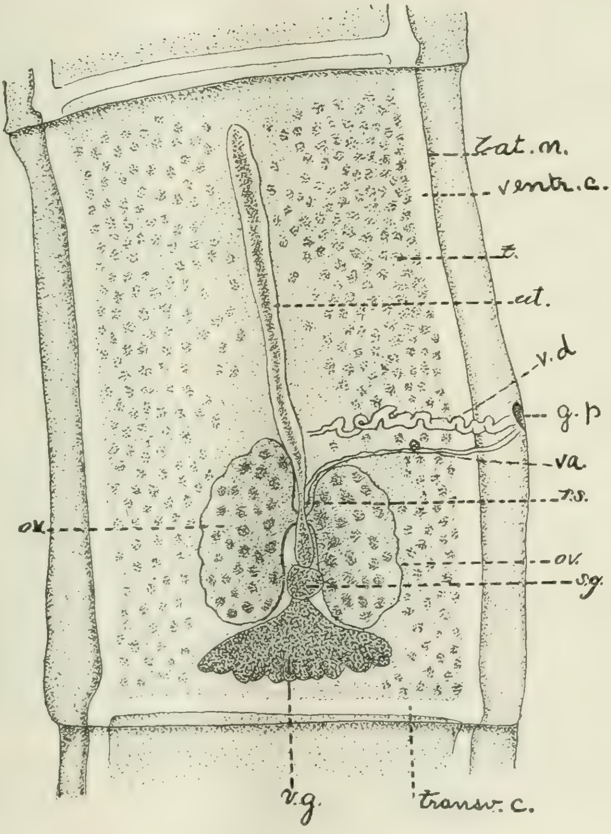

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FIG. 68.—Portions of strobila of *Tænia confusa*: *a*, anterior end, a short distance back of head; *c*, mature segments; *f*, terminal gravid segments. Natural size. (After Guyer, 1898a, fig. 1.)

FIG. 69.—Mature segment showing anatomy: *lat. n.*, lateral nerve; *ov.*, ovary; *g. p.*, genital pore; *r. s.*; receptaculum seminis; *s. g.*, shell gland; *t.*, testicles: *transv. c.*, transverse canal; *ut.*, uterus; *va.*, vagina, *v. d.*, vas deferens; *ventr. c.*, ventral canal; *v. g.*, vitellogene gland. ×20. (After Guyer, 1898a, fig. 3.)

genital pore; testicles 0.089 to 0.096 mm.; seminal vesicle present; length of cirrus pouch, 0.31 mm. Gravid (terminal) segments attain 27 to 35 mm. long by 3.5 to 5 mm. broad Length of segments exceeds breadth in nearly entire worm. Uterus with 14 to 18 thick, short, dichotomous branches each side of median stem. Calcareous corpuscles sparse, attain 11μ. Eggs oval, 39 by 30μ.

Cysticercus: Unknown.

HABITAT.—Adult in intestine of man.

GEOGRAPHIC DISTRIBUTION.—Thus far known only for Nebraska.

MEDICAL SIGNIFICANCE. Unknown.

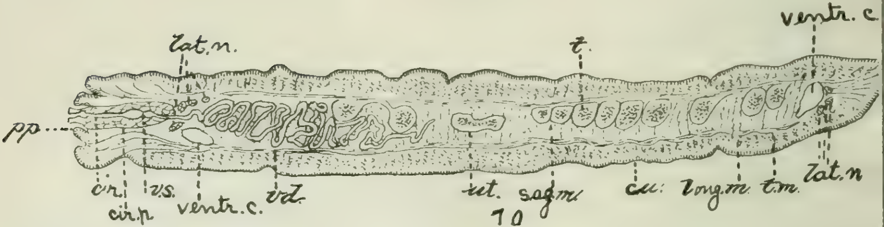


FIG. 70.—Transverse section of same: *cir.*, cirrus; *cir. p*,, cirrus pouch; *cu.*, cuticle; *long. m.*, longitudinal muscles; *p.p.*, pore plug; *sag. m.*, sagittal muscles; *t. m.*, transverse muscles; *v. s.*, vesicula seminalis; other letters same as in fig. 69. × 40. (After Guyer, 1898a, fig. 4.)

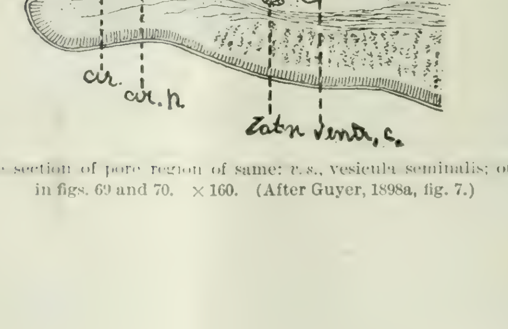
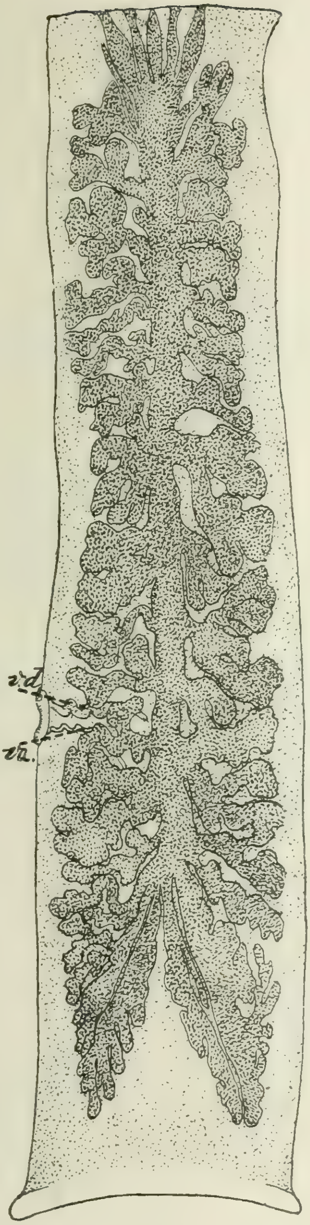


FIG. 71.—Transverse section of pore region of same: *v.s.*, vesicula seminalis; other letters same as in figs. 69 and 70. × 160. (After Guyer, 1898a, fig. 7.)



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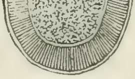

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Fig. 72.—Gravid segment, to show the uterus. × 6. (After Guyer, 1898a, fig. 2.)

Fig. 73.—Onchosphere surrounded by embryophore, from uterus. × 660. (After Guyer, 1898a, fig. 11)

Subfamily DIPYLIDIINÆ[a] Stiles, 1896.

SUBFAMILY DIAGNOSIS. *Tæniidæ* (p. 24): Suckers unarmed. Rostellum armed, rarely absent. Genital pores marginal (lateral), single or double and opposite. Genital organs of each segment in single or double series. Uterus usually dividing up into egg sacks, or entirely disappearing so that the eggs lie free in the parenchyma. Eggs with thin transparent shells, with or without appendages. Larval forms (cysticercoides) in arthropods or mollusks. Strobila in mammals, birds, and reptiles.

TYPE GENUS. *Dipylidium* Leuckart, 1863.

Of the genera *Dipylidium*, *Cotugnia*, *Oochoristica*, *Panceria*, *Monopylidium*, *Hymenolepis*, *Dilepis*, *Choanotænia*, *Amabotænia*, and *Nematotænia*, two groups (*Dipylidium* and *Hymenolepis*) are represented among the parasites of man.

KEY TO GENERA OF DIPYLIDIINÆ FOUND IN MAN.

Genital organs in double series; numerous testicles in each segment.	*Dipylidium* (p. 48)
Genital organs in single series; 3 testicles in each segment........	*Hymenolepis* (p. 51)

Genus DIPYLIDIUM[b] Leuckart, 1863.

GENERIC DIAGNOSIS.—*Dipylidiinæ*: Rostellum retractile, armed with several rings of alternating rose-thorn hooklets, which usually have a discoidal base. Suckers unarmed. Genital pores double and opposite. Genital organs in double series. Testicles very numerous, in median field. Ovary bilobed. Vitellogene glands distal of ovary. Uterus at first representing a reticulum, in the meshes of which are situated the testicles; later it breaks up into egg sacks inclosing one or several eggs. Eggs with double shell. Parasitic in mammals.

TYPE SPECIES.—*Dipylidium caninum* (Linnæus, 1758).

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[a] SYNONYMS.—*Rhynchotænia* Diesing, 1850a; *Malacolepidota* Weinland, 1858a; *Cystoideæ* Leuckart, 1863; *Cystoidei* Leuckart, 1886; *Cystoidotænia* Railliet, 1886; *Microtæniæ* Claus, 1891; *Dipylidinæ* Railliet, 1896.

[b] SYNONYMS.—*Tænia* (*Dipylidium*) Leuckart, 1863; *Alyselminthus* Weinland, 1858, not Zeder, 1800; *Cryptocystis* Villot, 1882; *Microtænia* Sedgwick, 1884.

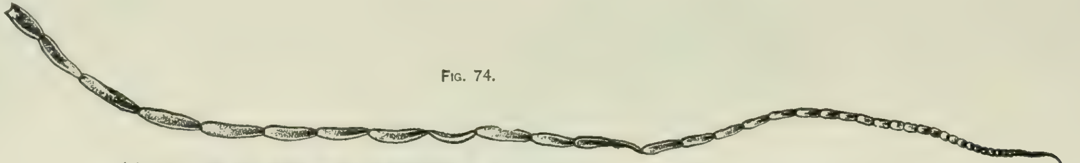

FIG. 74.

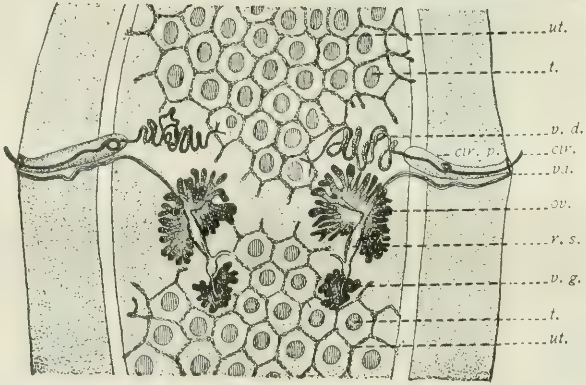

FIG. 75.

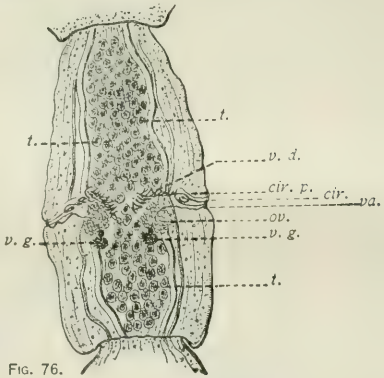

FIG. 76.

FIG. 74.—Adult strobila of the double-pored dog tapeworm (*Dipylidium caninum*). Natural size. (After Stiles, 1903, fig. 1.)

FIG. 75.—Mature segment of same, showing the anatomy: *cir.*, cirrus (penis); *cir. p.*, cirrus pouch; *ov.* ovary; *r. s.*, receptaculum seminis; *t.*, testicles; *ut.*, uterus; *va.*, vagina; *v. d.*, vas deferens; *v. g.*, vitellogene gland. ×25. (After Neumann in Railliet, 1893a, 289, fig. 188.)

FIG. 76.—Gravid segment of same; lettering same as in fig. 75. (After Diamare, 1893b, pl. 1, fig. 1.)

The Double-Pored Dog Tapeworm -DIPYLIDIUM CANINUM[a] (Linnæus, 1758).

[Figs. 74 to 80.]

Specific diagnosis.—*Dipylidium:* Strobila 15 to 35 cm. long; head small, globular; rostellum club-shaped, with 3 to 4 rows of hooks (about 60 in number), of rose-thorn form; the anterior hooks 15μ, the posterior 6μ; suckers, relatively large, rather elliptical. Segments 80 to 120 in number; gravid segments 8 to 11 mm. long, 1.5 to 3 mm. broad, often reddish in color. Genital pores at equator or in posterior half of segment; uterus forms egg capsules, each containing 8 to 20 eggs; eggs globular, 43 to 50μ in diameter; egg shell thin; onchosphere 32 to 36μ.

Fig. 77.

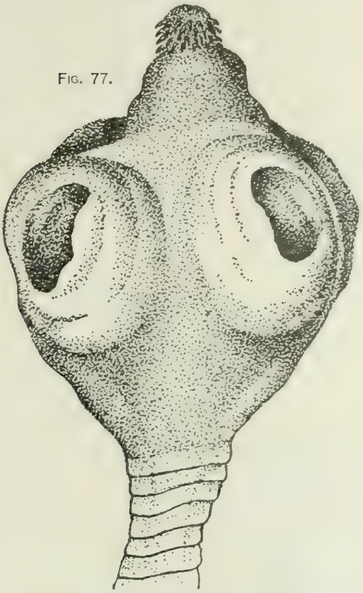

Fig. 79.

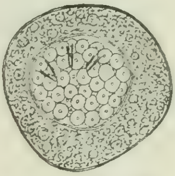

Fig. 80.

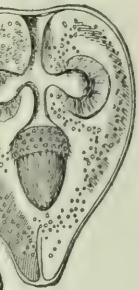

Fig. 78.

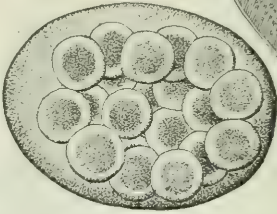

Fig. 77.—Head of same, showing four rows of rose-thorn hooks on the rostellum and four unarmed suckers. Greatly enlarged. (After Stiles, 1903, fig. 4.)

Fig. 78.—Egg packet of same, greatly enlarged. (After Stiles, 1903, fig. 5.)

Fig. 79.—Egg of same. Note the six hooks in the embryo. Greatly enlarged. (After Stiles, 1903, fig. 6.)

Fig. 80.—*Cryptocystis trichodectis*, the cystic (infecting) stage of *Dipylidium caninum*, as found in the flea. (After Leuckart, 1886, 847, fig. 348.)

Habitat.—Adults in small intestine of dogs (*Canis familiaris*) and cats (*Felis catus*); occasionally as accidental parasite in man. Larvæ in lice (*Trichodectes canis*) and fleas (*Ctenocephalus canis* and *Pulex irritans*).

Geographic distribution.—Probably more or less cosmopolitan.

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[a] Synonyms.—*Tænia canina* Linnæus, 1758a; *T. moniliformis* Pallas, 1781 (not Batsch, 1786a); *T. cucumerina* Bloch, 1782a; *T. cateniformis* Goeze, 1782a; *T. elliptica* Goeze, 1782a; *T. elliptica* Batsch, 1786a; *T. moniliformis* Schrank, 1788; *T. cateniformis canina* Linnæus of Gmelin, 1790a; *T. cateniformis felis* Gmelin, 1790a; *Alyselminthus ellipticus* (Batsch, 1786a) Zeder, 1800a; *Halysis elliptica* (Batsch, 1786a) Zeder, 1803a; *Tenia canina* (Linnaeus, 1758a) Beneden, 1861a; *T. cucumerina* (Bloch, 1782a) Beneden, 1861a; *Tænia* [(*Dipylidium*)] *cucumerina* Bloch of Leuckart, 1863; *Cryptocystis trichodectis* Villot, 1882; *Dipylidium caninum* (Linnaeus, 1758a) Railliet, 1893a.

Bibliography. See Diamare, 1893b.

Medical significance.—Probably a purely accidental parasite for man, more likely to occur in children. The worms have a tendency to burrow into the intestinal mucosa, making a tunnel-like channel, through which the segments are pulled much like a train of cars passing through a tunnel.

Prevention. Children should not be allowed to play with dogs and cats that are infested with fleas and lice.

Genus HYMENOLEPIS[a] Weinland, 1858.

Generic diagnosis.—*Dipylidiinæ* (p. 48): Head generally small; rostellum retractile well developed and armed, or rudimentary and unarmed; suckers usually unarmed. Genital pores single, marginal, unilateral. Testes few; usually three in each segment. Uterus saclike; often filling the segment; frequently with outpocketings and incomplete partitions. Eggs with two, three, or four membranes, the inner of which closely invests the embryo and may exhibit a small mammillate projection at each pole; the outer membrane is separated from the inner by a wide intervening space. Larva a cercocyst or staphylocyst.

Type species.—*Hymenolepis flavopunctata* Weinland, 1858 = *H. diminuta* (Rudolphi, 1819).

KEY TO THE SPECIES OF HYMENOLEPIS REPORTED FOR MAN.

(For species thus far found in man in the United States, follow roman type.)

Strobila small, 5 to 45 mm. long by 0.5 to 0.9 mm. wide, filiform; head armed with a crown of 20 to 30 hooks; eggs generally oval, with filaments attached to the poles of the inner membrane; common. *Hymenolepis nana* (p. 51)

Strobila 10 to 60 mm. long by 2.5 to 4 mm. wide; head unarmed; eggs generally round, prominent intermediate layer of albuminous substance between outer and inner membranes, outer membrane frequently with radial striations; rare in man .... *Hymenolepis diminuta* (p. 54)

Strobila lanceolate, 30 to 130 mm. long by 5 to 18 mm. broad; head small, compared with strobila, armed with 8 to 10 hooks; eggs oval, without filaments on the inner membrane; very rare in man .... Hymenolepis lanceolata (p. 58)

The Dwarf Tapeworm—HYMENOLEPIS NANA[b] (Siebold, 1852) Blanchard, 1891.

[Figs. 81 to 87.]

Specific diagnosis.—*Hymenolepis* (p. 51): Strobila 5 to 45 mm. in length, 0.5 to 0.9 mm. in maximum breadth, composed of about 100 to 200 segments. Head subglobular, 130 to 480μ in diameter; rostellum well developed, freely movable, armed with a single crown of 20 to 30 hooks, 14 to 18μ in length; suckers globular, 80 to 150μ in diameter. Neck long. Anterior segments very short; following segments

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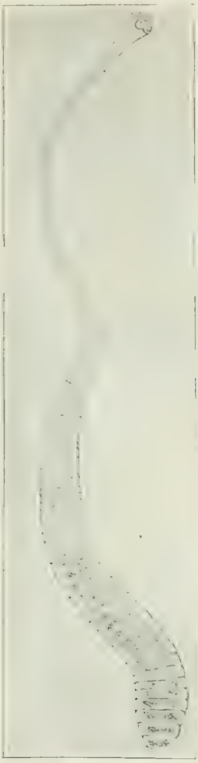
[a] Synonyms.—*Hymenolepis* Weinland, 1858; *Diplacanthus* Weinland, 1858 (not Agassiz, 1842, fish); *Lepidotrias* Weinland, 1858; "*Hymenolepsis*" of Osler, 1895, and other authors (misprint); "*Diplocanthus*" of Cohn, 1899 (misprint).

[b] Synonyms.—*Tænia murina* Dujardin, 1845a (not *T. murina* Gmelin, 1790a = *Cysticercus fasciolaris* Rudolphi); *Tænia nana* Siebold, 1852, not (van Beneden, 1858) Diesing, 1864a; *T. ægyptiaca* Bilharz, 1852, not Krabbe, 1869; *T. nania* Kuechenmeister, 1855, misprint for *nana*; *Diplacanthus nanus* (Siebold, 1852) Weinland, 1858; *Tænia* (*Hymenolepis*) *nana* Siebold of Leuckart, 1863; *T.* "*rana*" of Bell, 1886b (misprint); *Hymenolepis nana* Blanchard, 1891a; *H. murina* Blanchard, 1891a; "*Hymenolepsis*" *nana* of Osler, 1895, and other authors (misprint); *Tænia* "*minima*" of Huber, 1896a (misprint for *T. murina*).

Bibliography.—For medical and zoological discussion of this species, with compilation of 106 cases, see Ransom, 1904.

increase in length and breadth, but remain broader than long, except that the length of the hindermost segments may occasionally equal or even slightly exceed their breadth. Genital pores on the left margin, near anterior border of each segment. Three testes in each segment: vas deferens enlarged to form a seminal vesicle within the cirrus pouch, while a seminal reservoir outside the cirrus pouch is only slightly developed or absent. Gravid uterus occupies nearly the entire segment; wall of uterus with a few inconspicuous infoldings, forming incomplete partitions extending into the cavity of the uterus. Eggs number 80 to 180 in each segment; oval or globular; two distinct membranes; outer membrane 30 to 60μ in diameter; inner membrane 16 to 34μ in diameter, presenting at each pole a more or less conspicuous mammillate projection, provided with filamentous appendages; embryonal hooks 10 to 14μ long.



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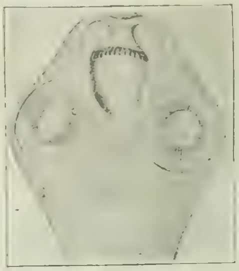

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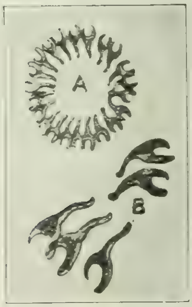

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FIG. 81.—Head and strobila of dwarf tapeworm (*Hymenolepis nana*). Enlarged. (After Leuckart, 1863, 393, fig. 112.)

FIG. 82.—Head of dwarf tapeworm (*H. nana*). Enlarged. (After Leuckart, 1863, 394, p. 113.)

FIG. 83.—Hooks of *Hymenolepis nana: a*, complete crown; *b*, isolated hooks. Enlarged. (After Krantz, from Kuechenmeister & Zuern, 1881a, pl. 5, fig. 4.)

HABITAT.[a]—Small intestine of brown or Norway rat (*Mus decumanus*), black rat (*Mus rattus*), dwarf field mouse (*Mus minutus*), house mouse (*Mus musculus*), garden dormouse (*Eliomys quercinus*), and man (*Homo sapiens*).

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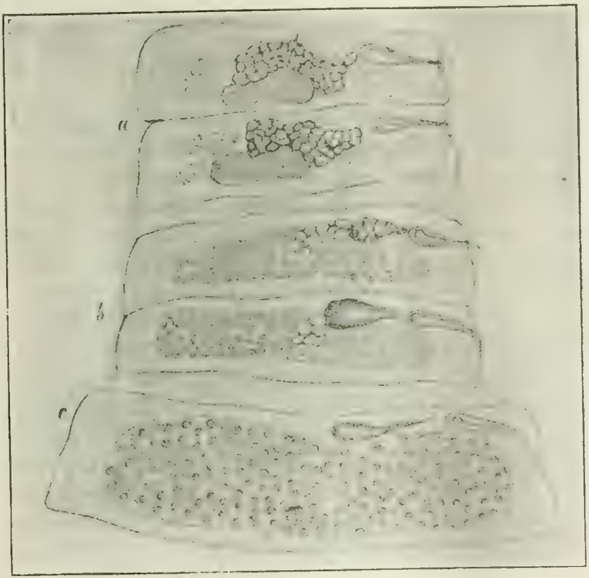
[a] There is some slight doubt as yet as to the absolute identity of the parasite in man with that of rodents, but from a standpoint of prevention they should at present be considered identical. The form in the rat (type host *Mus decumanus*, in France) may at least be viewed as a host subspecies (*H. nana fraterna* Stiles, 1906).

DEVELOPMENT.—The embryo is swallowed, and after hatching enters a villus of the small intestine, where it transforms into a cercocystis, which in turn falls into the lumen of the intestine and becomes adult.

GEOGRAPHIC DISTRIBUTION.—Egypt, England, Italy, Sicily, Russia, Germany, Servia, France, Austria, Denmark, Siam, Japan, Pennsylvania, District of Columbia, Maryland, South Carolina, Georgia, Texas, Brazil, and Argentina.

MEDICAL SIGNIFICANCE.—This parasite is more or less common, particularly in children in warmer climates. Treatment: male fern.

PREVENTION.—If a patient harbors this tapeworm he should not be allowed to sleep in the same bed with another person. Personal cleanliness, especially after defecation.



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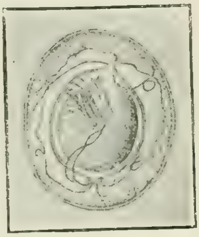

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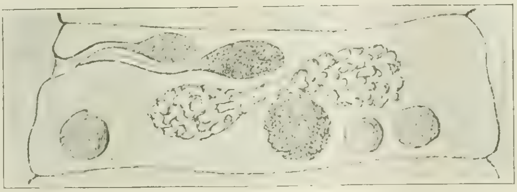

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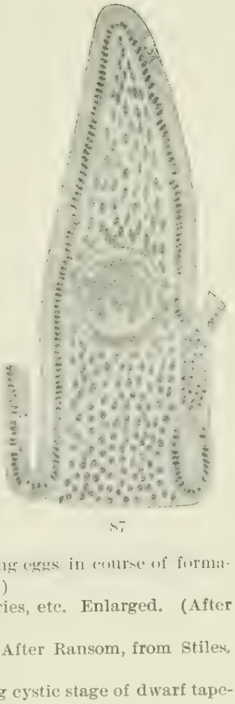

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FIG. 84.—Proglottids of *Hymenolepis nana*: *a*, showing ovary; *b*, containing eggs in course of formation; *c*, gravid segment. Enlarged. (After Leuckart, 1863, 396, fig. 114.)

FIG. 85.—Segment of *Hymenolepis nana* showing three testicles, two ovaries, etc. Enlarged. (After Leuckart, 1886, fig. 409a.)

FIG. 86.—Egg of *Hymenolepis nana* as seen in fresh feces. Enlarged. (After Ransom, from Stiles, 1903, 85, fig. 85.)

FIG. 87.—Longitudinal section of the intestinal villus of a rat, containing cystic stage of dwarf tapeworm. Enlarged. (After Grassi & Rovelli, 1892a, pl. 3, fig. 25.)

The Yellow Spotted Tapeworm HYMENOLEPIS DIMINUTA[a] (Rudolphi, 1819) Blanchard, 1891.

[Figs. 88 to 95.]

Specific diagnosis. *Hymenolepis* (p. 51): Strobila 10 to 60 mm. in length, 2.5 to 4 mm. in maximum breadth; composed of 800 to 1,300 segments. Head small, almost globular; 200 to 600μ in width; rostellum rudimentary, pyriform, only slightly protractile; hooks absent; suckers globular, near the apical portion of the head, 80 to 160μ in diameter. Neck usually short. Segments throughout strobila broader than long. Genital pores on left margin, near the junction of the anterior and middle thirds of each segment. Three testes in each segment; vas deferens dilates into a prominent seminal vesicle before entering the cirrus pouch, within which also is a vesicle. Gravid uterus occupies most of the proglottids; its cavity is subdivided into a large number of incompletely separated compartments filled with eggs. Eggs round or slightly oval; outer membrane 54 to 86μ in diameter, yellowish in color, may be radially striated; inner membrane 24 by 20μ to 40 by 35μ in diameter, with mammillate projection at each pole often not apparent; between outer and inner membranes a prominent third layer of albuminous substance, often appearing as two delicate smooth membranes, with intervening space filled by a granular coagulum; embryonal hooks 11 to 16μ in length.

Habitat.—Adults in small intestine of brown or Norway rat (*Mus decumanus*), black rat (*M. rattus*), house mouse (*M. musculus*), Egyptian or roof rat (*M. rattus alexandrinus*), wood or field mouse (*M. sylvaticus*), *Rhipidomys pyrrhorhinus* [according to Linstow, 1878a, 23], and man (*Homo sapiens*).

Development.—The larval stage (*Cercocystis H. diminutæ*) occurs in larval and adult meal moths (*Asopia farinalis*); in young and adult earwigs (*Anisolabis annulipes*); and in adult beetles (*Acis spinosa* and *Scaurus striatus*).

Geographic distribution.—Massachusetts, Pennsylvania, Nebraska, Iowa, District of Columbia, Maryland, Brazil, Italy, Germany, France, Austria.

Medical significance. A rare and probably accidental parasite of man; easily expelled.

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[a] Synonyms.—*Tænia diminuta* Rudolphi, 1819a; *T. leptocephala* Creplin, 1825a; *Hymenolepis flavopunctata* Weinland, 1858; *Tænia* (*Hymenolepis*) *flavopunctata* Weinland, 1859; *H.* (*Lepidotrias*) *flavopunctata* Weinland, 1861; *T. flavomaculata* Leuckart, 1863; *T.* "*flavopuncta*" Cobbold, 1864b (misprint); *T.* "*flaviopunctata*" Vogt, 1878 (misprint); *T.* "*flavopunktata*" Stein, 1882; *T. varesina* E. Parona, 1884; *T. minima* Grassi, 1886; *T.* "*septocephala*" Perroncito & Airoldi, 1888 (misprint); *Hymenolepis diminuta* (Rudolphi, 1819) Blanchard, 1891a; "*Hymenolepsis*" *flavopunctata* of Osler, 1895, and other authors (misprint); *T.* "*varerina*" Huber, 1896a (misprint for *T. varesina*); *T.* "*flavapunctata*" Simon, 1896 (misprint); *T.* "*leptocefala*" Previtera, 1900; *T.* "*ceptocephala*" Lussana & Romaro [? date] (misprint); *Tænia flavopunctata* (Weinland, 1858) Packard, 1900.

Bibliography.—For medical and zoological discussion of this species, with compilation of 10 cases, see Ransom, 1904.

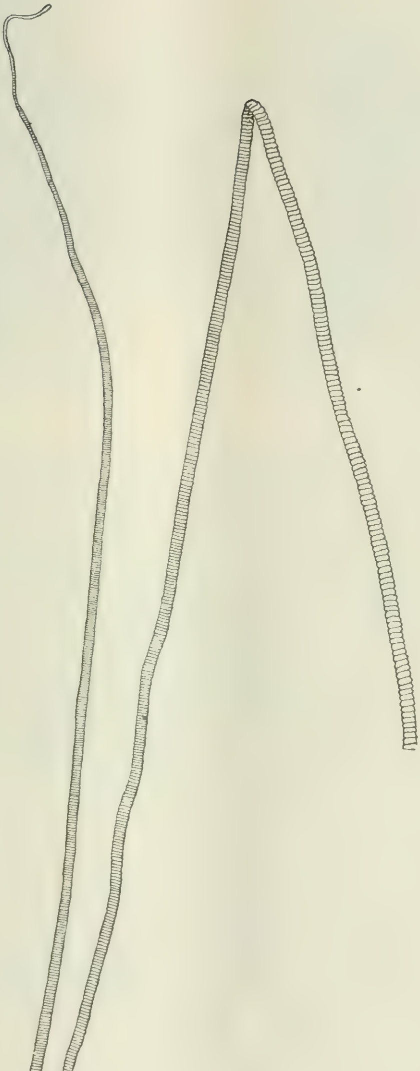
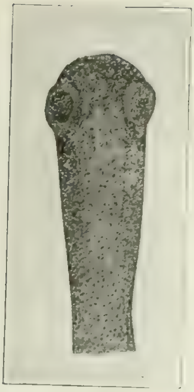


FIG. 88.—Strobila of *Hymenolepis diminuta*. Natural size (After Grassi, 1881, pl. 11, fig. 1.)



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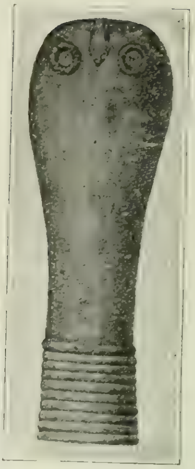

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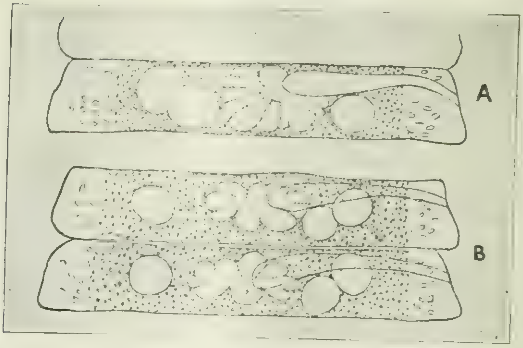

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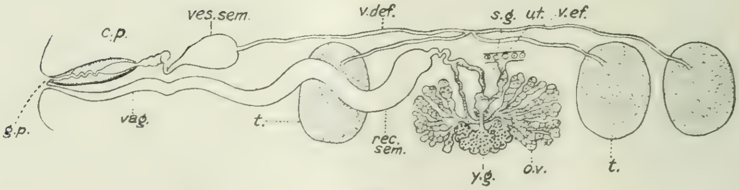

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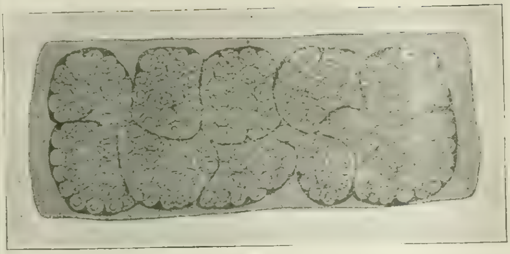
FIG. 89.—Head and neck of *H. diminuta* from man. Enlarged. (After E. Parona, 1884, fig. 4.)

FIG. 90.—Head and anterior portion of *H. diminuta* from the rat. Enlarged. (After Zschokke, 1889, pl. 1, fig. 21.)

FIG. 91.—Segments of *H. diminuta* showing the usual (A) and unusual (B) position of testes. Enlarged. (After Grassi, 1888, pl. 11, fig. 14.)

FIG. 92.—Male and female organs of *H. diminuta*: *c. p.*, cirrus pouch; *g. p.*, genital pore; *ov.*, ovary; *rec. sem.*, receptaculum seminis; *s. g.*, shell gland; *t.*, testes; *ut.*, uterus; *vag.*, vagina; *v. def.*, vas deferens; *v. ef.*, vas efferens; *ves. sem.*, vesicula seminalis; *y. g.*, yolk gland. Enlarged. (After Zschokke, 1889, pl. 2, fig. 22.)



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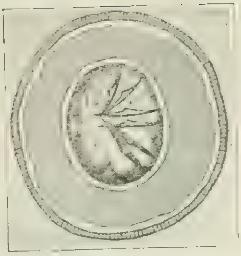

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FIG. 93.—Gravid segment of *H. diminuta*. Enlarged. (After Grassi, 1888l, pl. 11, fig. 15.)

FIG. 94.—Egg of *H. diminuta* from man. Greatly enlarged. (After Bizzozero, 1889a, pl. 4, fig. g″.)

FIG. 95.—Encysted cystic stage of *H. diminuta*: *caud.*, caudal appendage; *cyst.*, adventitious capsule inclosing the cercocystis. Enlarged. (After Grassi & Rovelli, 1892a, pl. 4, fig. 1.)

The Lanceolate Tapeworm—HYMENOLEPIS LANCEOLATA[a] (Bloch, 1782) Weinland, 1858.

[Figs. 96 to 100.]

Specific diagnosis.—*Hymenolepis* (p. 51): Strobila lanceolate, 30 to 130 mm. long by 5 to 18 mm. broad. Head, compared with strobila, very small; rostellum protractile, armed with single row of 8 hooks, 31 to 35μ long. Neck short, often retracted with head into anterior portion of strobila. Segments much broader than long throughout the strobila. Genital pores on right-hand margin of segment near anterior border. Three testes in each segment; vas deferens enlarged to form a seminal vesicle, frequently S-shaped, before entering cirrus pouch; within latter a second vesicle; vas deferens describes a complete loop in cirrus pouch before being transformed into the cirrus; cirrus freely protrusible, armed with spines. Female organs on opposite side of segment from genital pore; gravid uterus sac-like, with out-pocketings, filling most of the segment. Egg oval or spherical, with two thin membranes separated by an intervening space containing a small amount of albuminous substance; inner membrane occasionally with polar papillæ; outer membrane 50 by 35μ to 100 by 100μ in diameter; inner membrane 30 by 25μ to 40 by 25μ in diameter; embyronal hooks 8 to 15μ in length.

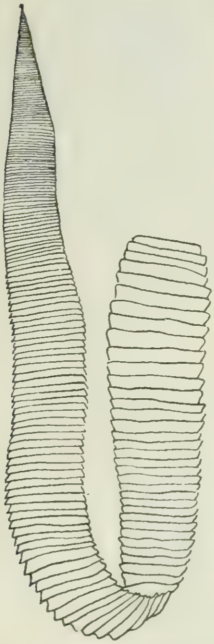

Fig. 96.—Head and strobila of *Hymenolepis lanceolata*. Natural size. (After Gœze, 1782a, pl. 29, fig. 23.)

Habitat.—Adults in intestine of tame duck (*Anas boschas domestica*); black duck (*Anas obscura*); tame goose (*Anser anser domesticus*); muscovy duck (*Cairina moschata*); white-headed duck (*Erismatura leucocephala*); pochard (*Aythya ferina*); African teal (*Aythya nyroca*); red-crested pochard (*Aythya rufina*); flamingo (*Phœnicopterus roseus*). Zschokke (1902) has recently reported one case in man (*Homo sapiens*).

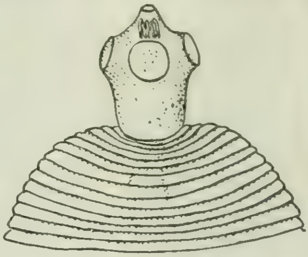

Fig. 97.—Head with retracted rostellum and anterior portion of *H. lanceolata*. Enlarged. (After Railliet, 1886, 267, fig. 163a.)

Development.—Not experimentally determined. Larval stage probably lives in small fresh-water crustacea.

Geographic distribution.—England, Denmark, France, Germany, and Austria.

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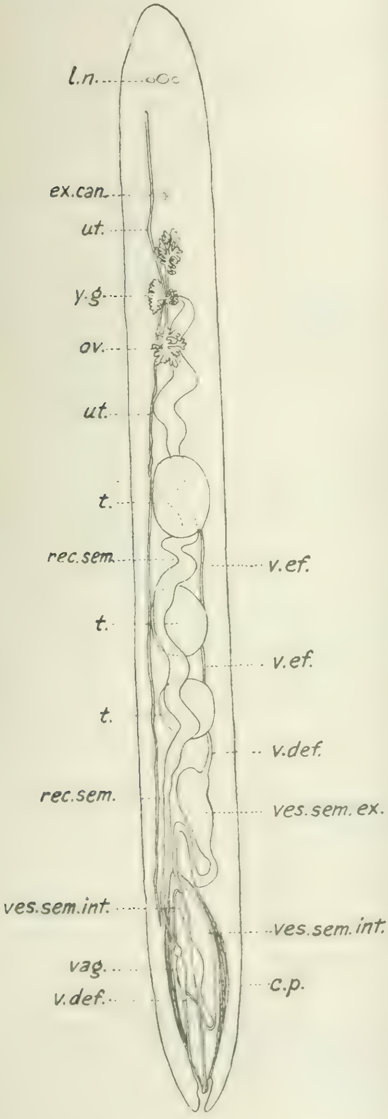
[a] Synonyms.—*Tænia anserum* Frisch, 1727 [according to Rudolphi, 1810a]; *T. anseris* Bloch, 1779 [according to Rudolphi, 1810a]; *T. lanceolata* Bloch, 1782a (not *T. lanceolata* Chabert; not *T. lanceolata* Rosseter, 1891); *T. acutissima* Pallas, 1781, in part; *T. lanceola* Batsch, 1786a; *Halysis lanceolata* (Bloch, 1782) Zeder, 1803a; *Hymenolepis* (*Dilepsis*) *lanceolata* (Bloch, 1782) Weinland, 1858; *Drepanidotænia lanceolata* (Bloch, 1782) Railliet, 1892; *Hymenolepis* (*Drepanidotænia*) *lanceolata* (Bloch, 1782) Cohn, 1899; *Tænia Drepanidotænia lanceolata* (Bloch, 1782) Dadai, 1900a.

Bibliography.—For medical and zoological discussion, see Ransom, 1904.

Medical significance. An accidental parasite in man; only one case has been recorded.



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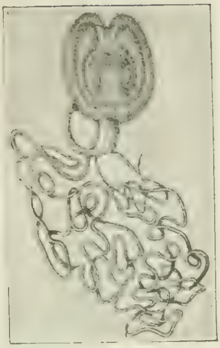

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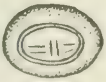

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Fig. 98.—Transverse section of segment of *H. lanceolata*: *c. p.*, cirrus pouch; *ex. can.*, excretory canals; *l. n.*, lateral longitudinal nerves; *ov.*, ovary; *rec. sem.*, receptaculum seminis; *t.*, testis; *ut.*, uterus; *vag.*, vagina; *v. def.*, vas deferens; *v. ef.*, vas efferens; *ves. sem. ex.*, vesicula seminalis externa; *ves. sem. int.*, vesicula seminalis interna; *y. g.*, yolk gland. Enlarged. (After Wolffhügel, 1900b, 51, fig. 2.)

Fig. 99.—Egg of *H. lanceolata*. Enlarged. (After Railliet, 1886, 267, fig. 163b.)

Fig. 100.—Supposed cystic stage of *H. lanceolata*. Enlarged. (After Daday, 1900a, pl 10, fig. 9.)

Subfamily DAVAINEINÆ Braun, 1900.

SUBFAMILY DIAGNOSIS.—Tæniidæ (p. 24): Rostellum and suckers armed with hooks. Genital pores irregularly alternate or unilateral. Genital organs in single series. Eggs usually in egg-capsules. Parasites of mammals and birds.

TYPE GENUS.—*Davainea* Blanchard, 1891.

Of the genera *Davainea*, *Echinocotyle*, and *Ophryocotyle*, only *Davainea* occurs in man.

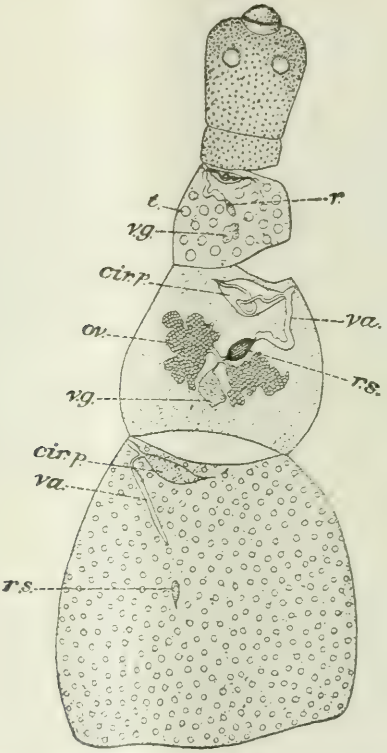

FIG. 101.—*Davainea proglottina*, type of genus, enlarged 95 times to show the anatomy: *cir. p.*, cirrus pouch; *ov.*, ovary; *r. s.*, receptaculum seminis; *t.*, testicles; *va.*, vagina; *v. g.*, vitellogene gland. (After Blanchard, 1891t, 430, fig. 4.)

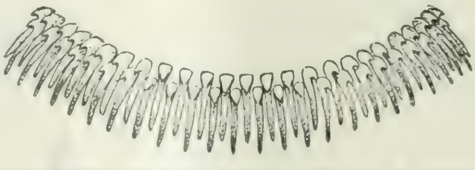

FIG. 102.—A portion of the double row of hooks on the rostellum of *Davainea salmoni* of rabbits. Greatly enlarged. (After Stiles, 1896n, pl. 23, fig. 6.)

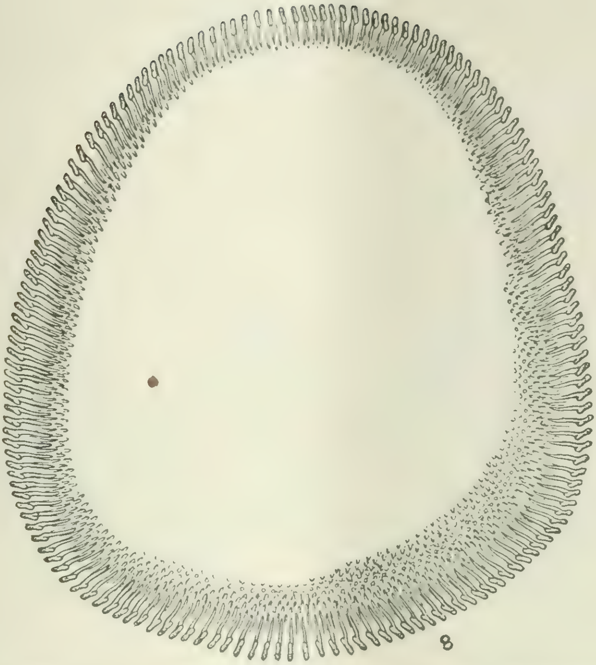

FIG. 103.—View of the hooks on a sucker of *Davainea salmoni* of rabbits. Greatly enlarged. (After Stiles, 1896n, pl. 23, fig 8.)

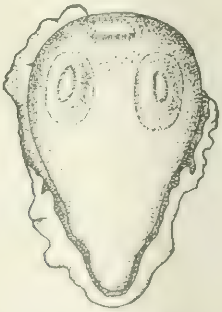

FIG. 104.—A very young *Davainea* [illegible] partially surrounded by a cyst, and showing armed rostellum and suckers; from the cottontail rabbit. Greatly enlarged. (After Stiles, 1896n, pl. 25, fig. 10.)

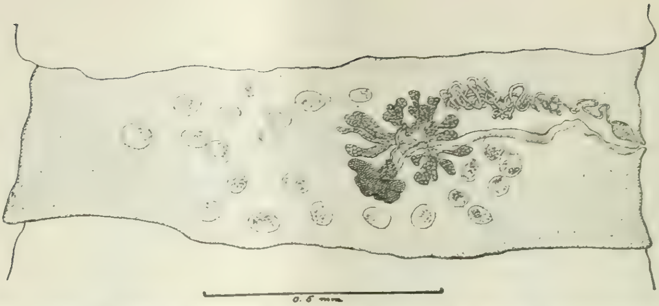

Fig. 105.—Segment of *Davainea tetragona* of chickens, enlarged to show the reproductive organs. (After Ransom, 1904, 60, fig. [illegible])

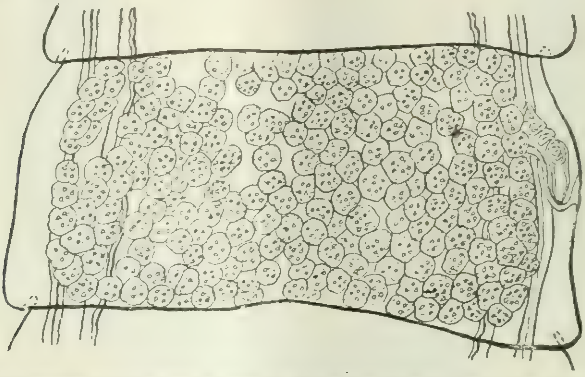

Fig. 106.—Gravid segment of *Davainea salmoni* of the cottontail rabbit, enlarged dorsal view showing longitudinal nerves and canals, cirrus pouch, vagina, and numerous egg capsules. (After Stiles, 1896, pl. 22, fig. 4.)

Genus DAVAINEA[a] Blanchard & Railliet, 1891.

Generic diagnosis.—*Davaineinæ* (p. 60): Scolex with a rostellum armed with numerous hammer-shaped hooklets, arranged in two rows. Suckers with several rings of small hooklets. Genital pores usually unilateral, less frequently irregularly alternate. Eggs in egg capsules, in nearly the entire middle field of the segments. Parasitic in mammals and birds. Larval form (a cysticercoid) in mollusks and arthropods.

Type species.—*Davainea proglottina* (Davaine, 1869).

The two species of this genus reported for man (neither of them known yet for North America) may be distinguished by the following key:

Testicles 50 or more in each segment; 300 to 400 egg balls in each gravid segment; calcareous corpuscles present . . . . *D. madagascariensis* (p. 63)

Testicles 14 to 15 on each transverse section, arranged in single ventral and dorsal rows; 60 to 80 egg balls in each gravid segment; calcareous corpuscles absent . . . . *D. asiatica* (p. 65)

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[a] Synonym.—? *Liga* Weinland, 1857, type, *punctata;* ?? *Chapmania* Monticelli, 1893, type *Tænia argentina.* In case of a division of the genus *Davainea*, the species reported for man will not remain in *Davainea* s. str.

The Madagascar Tapeworm—DAVAINEA MADAGASCARIENSIS[a] (Davaine, 1869) Blanchard, 1891.

[Figs. 107 to 108.]

Specific diagnosis.—*Davainea* (p. 62): Strobila attains 25 to 30 cm. in length by 1.4 mm. in breadth, and is composed of 500 to 600 segments, of which the last 100 are gravid and form one-half of the total length of the worm. Head with 4 large, round suckers; rostellum retractile, 0.1 mm. in diameter, plump, with 90 peculiar hooks (18 μ long) at its equator; the inner surface of the rostellum-pouch provided with numerous minute points, which are found also on the inner surface of the suckers. Proximal segments broader than long; gravid segments become longer than broad (2 by 1.4 mm.) and resemble apple seeds in shape; the distal 100 segments compose about one-half of the entire worm. Calcareous corpuscles present. Sexual development very rapid, so that segments 3 cm. from head are in copula. Genital pores unilateral, near proximal corner of segment; genital cloaca deep. *Male* organs: Cirrus pouch bottle-shaped; ductus ejaculatorius very long and sinuous, provided with prostatic gland-cells; testicles numerous, 50 or more. *Female* organs: Receptaculum seminis unusually long and broad, extending to median line of segment and communicating with oviduct; shell-gland included in the vitelloduct; uterus composed of a number of tubes which roll up each side in a nearly globular ball; when uterus is filled with eggs, the windings of the uterus unroll, extend throughout the segment, and lose their walls, so that the eggs now lie free in the parenchyma; the eggs then become surrounded, singly or 2 or 3 together, by parenchymatic cells, forming egg-balls, of which 300 to 400 are present. Onchosphere (8 μ to 15 μ) is surrounded by 2 clear shells, the outer bearing 2 mammillate projections.

Larval stage unknown; probably in some invertebrate. Blanchard suggests that cockroaches (*Blatta orientalis*) may possibly be the intermediate host.

Habitat.—Adult in intestine of man, chiefly children.

Geographic distribution.—Tropical regions of Old and New World, possibly more common

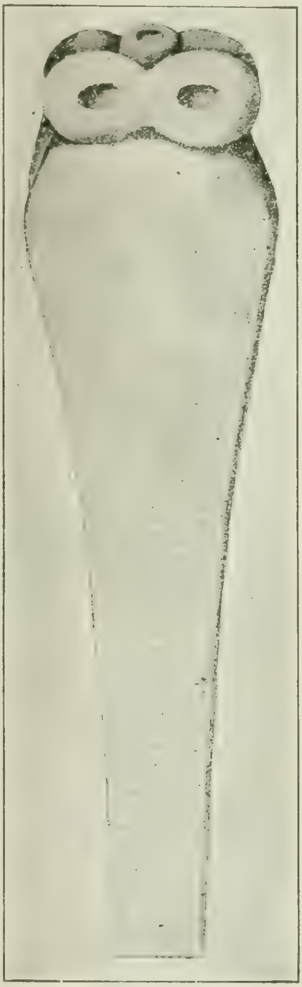

Fig. 107.—Head and anterior portion of *Davainea madagascariensis;* the hooks have fallen from the specimen. × 27. (After Blanchard, 1899d, 202, fig. 1.)

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[a] Synonyms.—*Tænia madagascariensis* Davaine, 1870e; *T. demerariensis* Daniels, 1895d.

Bibliography.—For list of cases see Blanchard, 1899d.

than assumed at present. Thus far reported in 9 or 10 cases, from Mayotte (Comoro Islands, by Grenet), Port Louis (Mauritius Island, by Chavereau), Nossi-bé Island (Davaine Collection, reported by Blanchard), and Georgetown (British Guiana, by Daniels).

Medical significance.—Unknown.

Prevention.—Unknown.

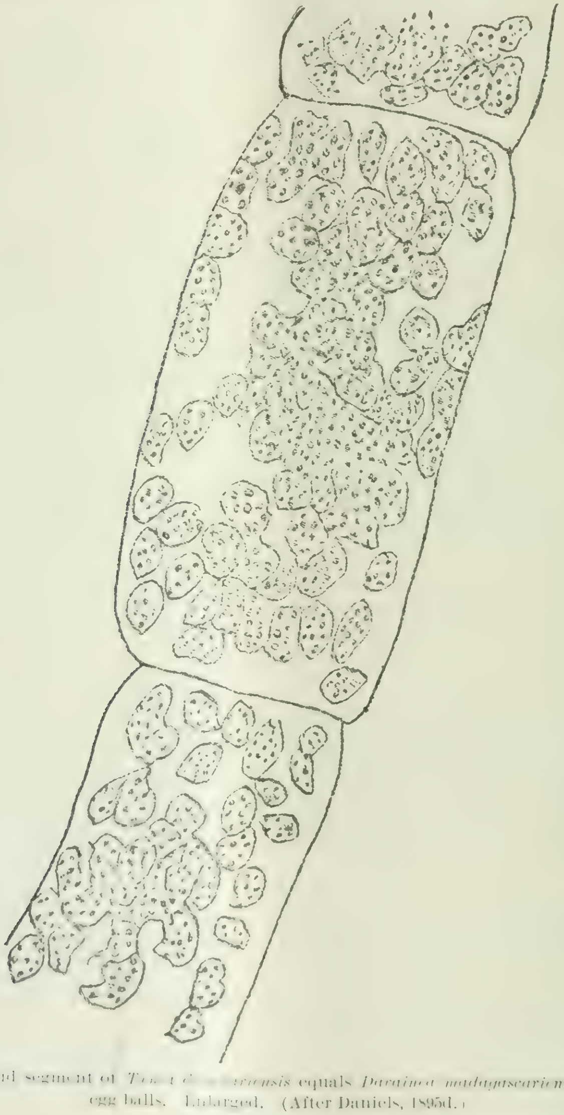

Fig. 108.—Gravid segment of *Taenia madagascariensis* equals *Davainea madagascariensis*, showing the egg balls. Enlarged. (After Daniels, 1895d.)

The Asiatic Tapeworm—DAVAINEA ASIATICA [a] (Linstow, 1901).

[Figs. 109 to 113.]

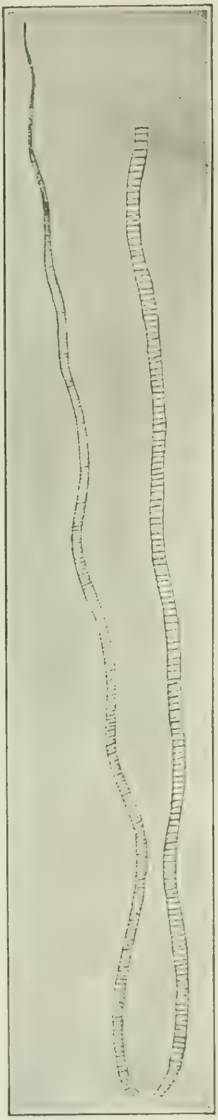

FIG. 109.—Strobila of *Davainea asiatica*. Natural size. (After Linstow, 1901, 983, fig. 1.)

SPECIFIC DIAGNOSIS.—*Davainea* (p. 62): Length 29.8 cm., maximum breadth 1.276 mm., composed of about 750 segments. Head unknown. Segments all broader than long, varying in size from the anterior to the terminal as follows: 0.16 mm.; 0.67 by 0.32 mm.; 1.056 by 0.352 mm.; 1.276 by 0.88 mm.; 1.78 by 0.99 mm.; thickness, 0.238 in middle segments to 0.484 mm. in terminal segments; the distal margin of each segment extends over the proximal margin of the next following segment. Cortical layer $\frac{1}{5}$ of dorso-ventral diameter of segment. Ventral canals very large, $\frac{3}{5}$ of dorso-ventral and $\frac{1}{6}$ to $\frac{1}{8}$ of lateral diameter of segment, connected distally in each segment by transverse canal 88 μ in diameter; dorsal canals much smaller, $\frac{1}{14}$ of dorso-ventral and $\frac{1}{60}$ of transverse diameter of segment, situated dorso-median of ventral canals. Lateral nerve about half-way between ventral canal and lateral margin. Calcareous corpuscles absent. Maturity of segments attained about 35 mm. from anterior end of strobila. Genital pores unilateral in proximal third of margin. *Male* organs: Testicles, 35 to 44 μ in diameter, 14 or 15 on each transverse section, arranged in single dorsal and ventral rows; vas deferens extends in convolutions about $\frac{1}{3}$ across the segment, dorsally of longitudinal canals and nerves; cirrus pouch pyriform, 79 μ long by 49 μ broad, does not quite reach the longitudinal nerve. *Female* organs: Ovary extends across the segment, from ventral canal to ventral canal; vitellogene gland nearly globular, median, dorsal of ovary, its transverse diameter about $\frac{1}{8}$ of the segment; vulva dorsal of cirrus; vagina extends dorsally of nerve and lateral canals, and at dorsal canal it widens into large, elongate, receptaculum seminis; uterus breaks up into 60 to 70 egg balls in each segment; mature eggs not observed, but probably about 38.6 by 36.4 μ.

HABITAT.—Adult in intestine of man. Larval stage unknown, probably in some invertebrate.

GEOGRAPHIC DISTRIBUTION.—Known only for Aschabad, Asiatic Russia.

MEDICAL SIGNIFICANCE.—Unknown.

PREVENTION.—Unknown.

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[a] SYNONYM.—*Tænia* [*Davainea*] *asiatica*, Linstow, 1901.

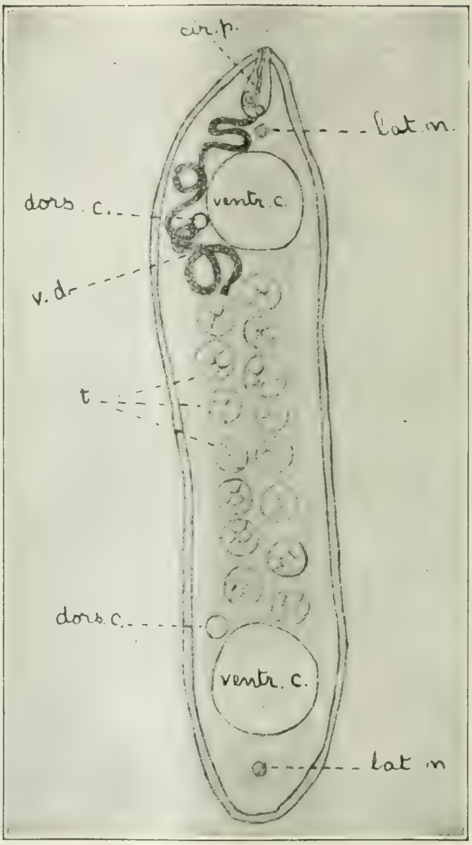

FIG. 110.—Diagram of transverse section of same to show the male organs: *cir. p.*, cirrus pouch; *dors. c.*, dorsal canals; *lat. n.*, nerves; *t.*, testicles; *ventr. c.*, ventral canals; *v. d.*, vas deferens. Enlarged. (After Linstow, 1901, 983, fig. 2.)

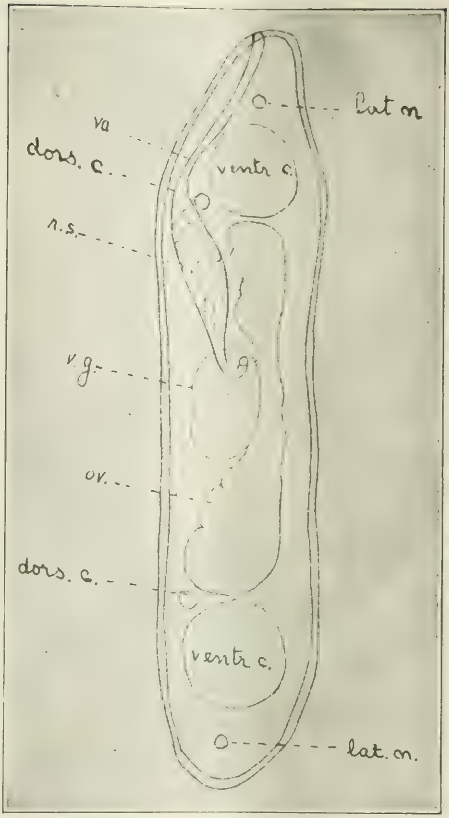

FIG. 111.—Diagram of transverse section of same to show the female organs: *ov.*, ovary; *r. s.*, receptaculum seminis; *va.*, vagina; *v. g.*, vitellogene gland; other letters same as in fig. 110. Enlarged. (After Linstow, 1901, 983, fig. 3.)

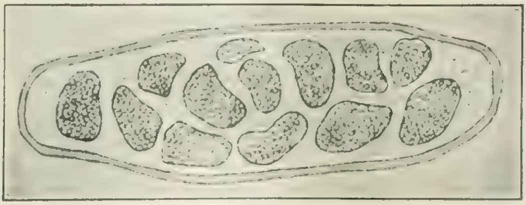

FIG. 112.—Transverse section of gravid segment to show the egg balls. Enlarged. (After Linstow, 1901, 984, fig. 4.)

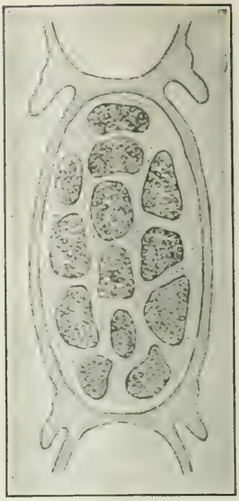

FIG. 113.—Sagittal section of same to show egg balls and the general outline of the segment. Enlarged. (After Linstow, 1901, 984, fig. 5.)

SOMATIC TÆNIASIS.

Somatic tæniasis is the infection of any organ with the larval stage of a tapeworm. In man we may have the four forms of somatic tæniasis mentioned on pp. 9–10.

Family TÆNIIDÆ.

(Subfamily TÆNIINÆ.)

CYSTICERCOSIS—INFECTION WITH CYSTICERCUS.

Infection with CYSTICERCUS CELLULOSÆ.[a]

[Figs. 54, 114 to 119.]

SPECIFIC DIAGNOSIS. See p. 37.

On p. 39 attention was directed to the fact that *Tænia solium* is a more dangerous parasite than *T. saginata* because of the danger of autoinfection. If, for instance, a patient who harbors *T. solium* soils his fingers with his feces, containing the eggs, and through carelessness infects himself with these eggs *per os*, or if through a reverse peristalsis a gravid segment of the worm gains access to his stomach, the onchospheres (embryos) upon becoming free from their shell, bore through the intestinal wall and come to rest in the muscles, eye, brain, or elsewhere, and develop into the cysticercal stage. In case of infection with *Tænia saginata* this danger of autoinfection is not present.

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[a] SYNONYMS See p. 30.

The seriousness of the cysticercal infection depends upon the location of the parasites and the number present.

CLINICAL DIAGNOSIS.—In case of superficial infection, the parasites may sometimes be felt through the skin; in case of infection in the eye, diagnosis is made by ophthalmoscopic examination; in case of cerebral infection, a presumptive diagnosis is made upon the clinical history combined with a positive knowledge of preexisting intestinal tæniasis due to *Tænia solium*.

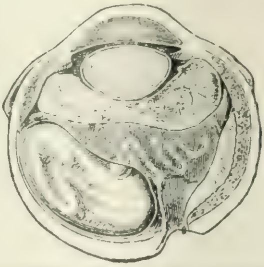


FIG. 114.—Subretinal cysticercus in the eye. × 1. (After von Wecker; from Leuckart, 1880, 700, fig. 298.)

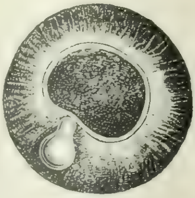


FIG. 115.—Cysticercus in anterior chamber. × 3. (After von Wecker; from Leuckart, 1880, 701, fig. 299.)

TREATMENT.—No medicinal treatment established. The parasites may, in many cases, be removed surgically.

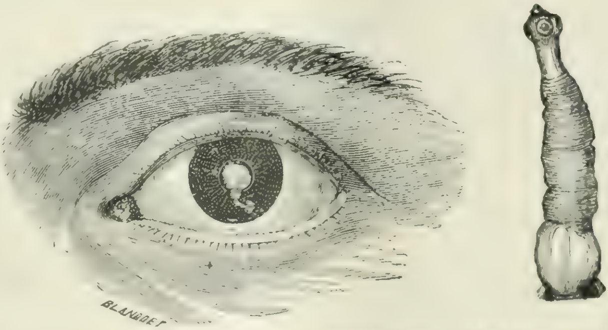


FIG. 116.—A cysticercus in the anterior chamber; A, isolated head. (After Blanchard, 1886a, 402, fig 244.)

PREVENTION.—Great personal cleanliness on the part of patients harboring *Tænia solium;* such patients should not occupy a bed with other persons: prevention of *T. solium*, see p. 39.

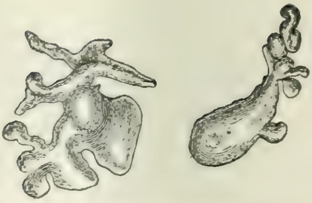


FIG. 117.—Racemose cysticerci. × 1. (After Marchand, from Leuckart, 1880, 702, fig. 300.)

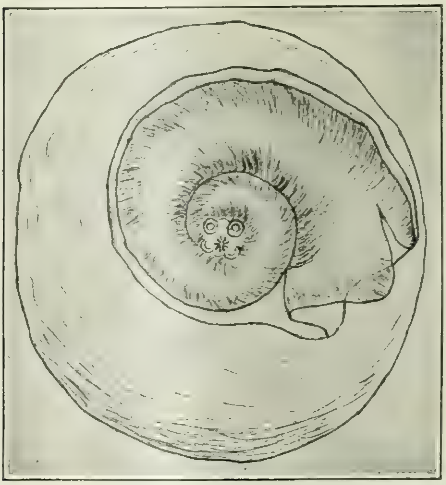


FIG. 118.—A cysticercus from the brain. × 12. (After Leuckart, 1880, 702, fig. 301.)

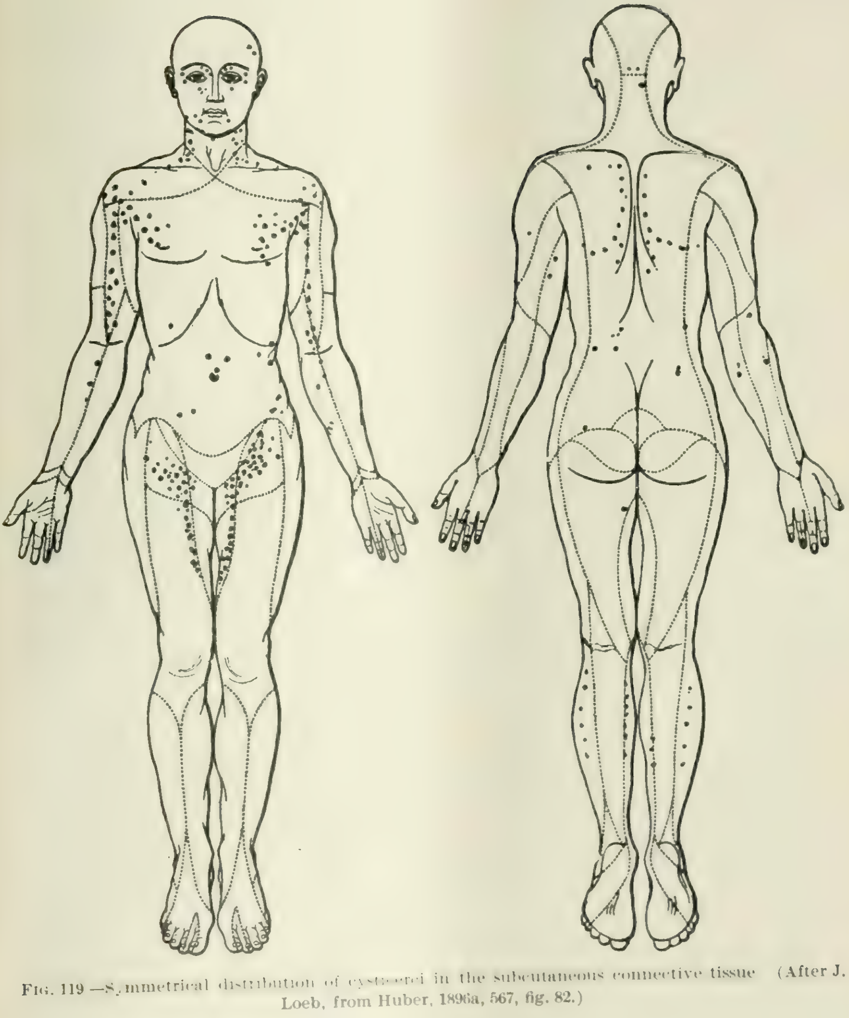


FIG. 119.—Symmetrical distribution of cysticerci in the subcutaneous connective tissue. (After J. Loeb, from Huber, 1896a, 567, fig. 82.)

The so-called CYSTICERCUS VISCERALIS and CYSTICERCUS TENUICOLLIS HOMINIS.

Early authors record as parasitic in man a cystic worm, which has been classified by various writers as *Cysticercus tenuicollis*, the larval stage of *Tænia hydatigena* (see p. 72) of dogs. Such serious doubts arise, however, in regard to the correctness of the zoological determination, that these parasites,[a] or alleged parasites, must at present be considered as unidentifiable. The parasite reported by Eschricht (1853a) as *Cysticercus tenuicollis* and quoted by Diesing (1864a) as *Cysticercus tenuicollis hominis* appears to have been a true *C. tenuicollis;* but, according to Krabbe (1866b), Eschricht has since stated that he believes this specimen came from sheep, instead of from man. Hodges (1867a, b) has reported a *Cysticercus tenuicollis* for man in the United States, but Braun (1894e) considers that this specimen may equally well be interpreted as a *C. cellulosæ.*

In view of the foregoing discussion, *Cysticercus tenuicollis* should not be definitely accepted as a parasite of man unless further and unequivocal cases are reported.

Specific diagnosis of *Tænia hydatigena*[b] (figs. 120 to 123).—*Tænia* (*Tænia*) (p. 36): Strobila attains 1.5 to 5 mm. in length. Head reniform, about 1 mm. in diameter; rostellum long and narrow, armed with a double row of 30 to 44 hooks, alternating large (180 to 220 μ) and small (110 to 160 μ). Neck rather long, nearly as broad as head. Segments become square about 60 cm. from head; distal border of segment irregularly undulate and covering proximal border of next segment like a cuff. Genital pore slightly salient. Gravid segments 50 to 70 in number, 4 to 7 mm. broad by 10 to 14 mm. long. Uterus with 5 to 8 lateral branches each side. Embryophores nearly spherical, 31 to 36 μ in diameter.

Cysticercus stage (*C. tenuicollis*[c]) attains considerable size, 16 cm. long by 6 to 7 cm. broad, or even larger (fig. 123).

---

[a] *Tænia visceralis* Gmelin, 1790a; *Cysticercus visceralis* (Gmelin, 1790a) Zeder, 1803a; *Finna visceralis* Brera, 1809a; *Cysticercus visceralis hominis* Rudolphi, 1810a; "*C. visceralis treutleri* Slawikowski, 1819."

[b] Synonyms.—*Tænia solium* Linnæus, 1758a in part; *T. cateniformis* Gœze, 1782a; ? *T. serrata* Gœze, 1782a, in part; *T. marginata* Batsch, 1786a; *T. lupina* Schrank, 1788; *T. cateniformis lupi* Gmelin, 1790a; *Halysis marginata* (Batsch, 1786a) Zeder, 1803a.

[c] Synonyms.—*Lumbricus hydropicus* Tyson, 1691; *Vermes vesiculares* Hartmann, 1705b; *Tænia hydatoidea* Pallas, 1760; *T. hydatigena* Pallas, 1766; *Hydra hydatula* Linnæus, 1767; *Vermis vesicularis eremita* Bloch, 1780a; *Hydatigena orbicularis* Gœze, 1782a; *H. globosa* Batsch, 1786a; *H. oblonga* Batsch, 1786a; *Vesicaria orbicularis* (Gœze, 1782a) Schrank, 1788; *Tænia simiæ* Gmelin, 1790a; *T. ferarum* Gmelin, 1790a; *T. caprina* Gmelin, 1790a; *T. ovilla* Gmelin, 1790a; *T. vervecina* Gmelin, 1790a; *T. bovina* Gmelin, 1790a; *T. apri* Gmelin, 1790a; *T. globosa* (Batsch, 1786a) Gmelin, 1790a; ? *Hydatula lienis* Gmelin, 1790a; ? *H. pulmonis* Gmelin, 1790a; *H. hepatis* Gmelin, 1790a; *H. cervorum* Gmelin, 1790a; *H. peritonæi* Gmelin, 1790a; *H. solitaria* Viborg, 1790; *Cysticercus clavatus* Zeder, 1803a; *C. globosus* (Batsch, 1786a) Zeder, 1803a; *C. simiæ* (Gmelin, 1790a) Zeder, 1803a; *C. caprinus* (Gmelin, 1790a) Zeder, 1803a; *C. lineatus* Laennec, 1804; *Physchiosoma globosum* (Batsch, 1786a) Brera, 1809a;

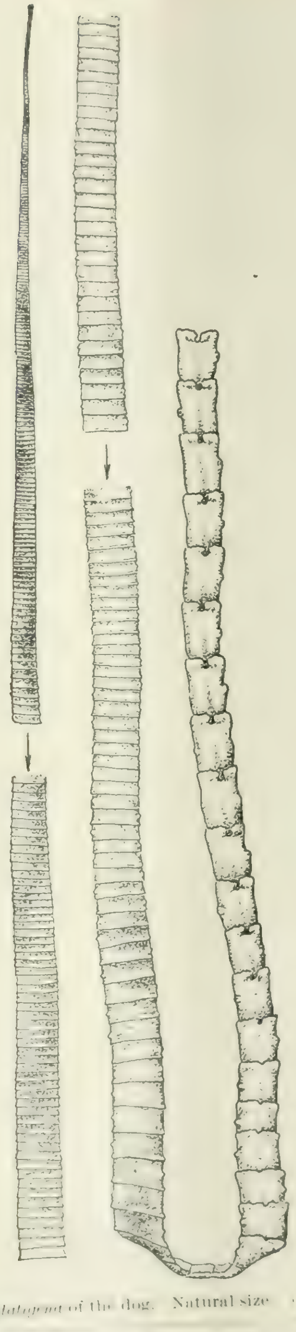


FIG. 120.—Strobila of *Tænia hydatigena* of the dog. Natural size. (After Stiles, 1898a, 97, fig. 85.)

Cysticercus tenuicollis Rudolphi, 1810a; *C. visceralis simiæ* Rudolphi, 1810a; *Tænia visceralis vesicularis orbicularis* Goeze of Lænnec, 1812; *T. hydatigena ovium* Pallas of Lænnec, 1812; *T. hydatigena suum* Pallas of Lænnec, 1812; *Hydatis globosa* (Batsch,

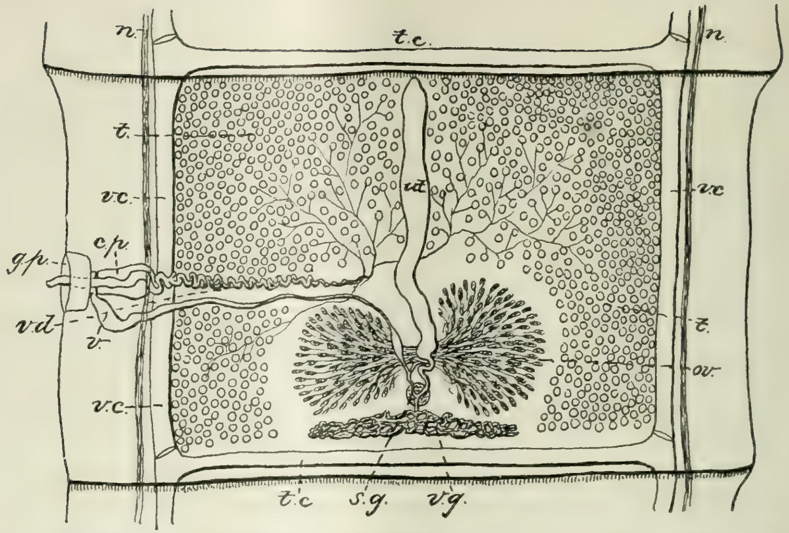
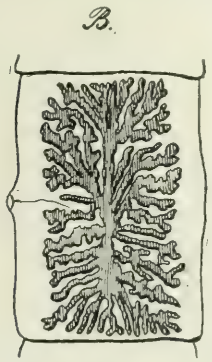


FIG. 121.—Mature segment of same, enlarged to show the anatomy: *c. p.*, cirrus pouch; *g. p.*, genital pore; *n.*, nerve; *ov.*, ovary; *s. g.*, shell gland; *t.*, testicles; *t. c.*, transverse canal; *ut.*, uterus; *v.*, vagina; *v. c.*, ventral canal; *v. d.*, vas deferens; *v. g.*, vitellogene gland. (After Deffke, 1891a; pl. 1, fig. 1.)



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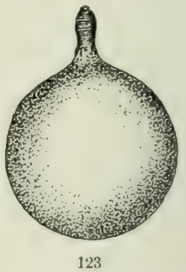

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FIG. 122.—Gravid segment of same, enlarged to show lateral branches of uterus. (After Leuckart, 1880, 720, fig. 308b.)

FIG. 123.—*Cysticercus tenuicollis* from a steer. Natural size. (After Stiles, 1898a, 97, fig. 84.)

HABITAT.—Adults in intestine of canines, as dogs and wolves; cysticercus in body cavity of various domesticated animals, as cattle, sheep, goats, swine; also reported for a number of wild animals.

GEOGRAPHIC DISTRIBUTION.—More or less cosmopolitan.

1786a) Lamarck, 1816; *Fischiosoma globosum* Brera of delle Chiaje, 1825a; *Tænia ferrarum* Gmelin of Diesing, 1850a; *Cysticercus hominis dubius* Diesing, 1854b; *C. ex potamochœro penicillato* Cobbold, 1861d; *C. potamochœri penicillati* Cobbold, 1861e; *C. potamochœri* Cobbold, 1861e; *C. tenuicollis hominis* Eschricht of Diesing, 1864a; *C. oris* Cobbold, 1869a; *C. oriparieus* Maddox, 1873; *C. phacochœri æthiopici* Cobbold of Linston, 1878; *Cisticercus oris* (Cobbold, 1869) Guzzardi Asmundo, 1885a.

This is the parasite which has been reported as *Tænia solium* of the dog by several authors, and by at least one State Board of Health.

Unidentifiable Cysticerci (?).

In the foregoing discussion certain parasites have been cited in the tables of synonymy, although I consider them at present unidentifiable; still, other authors have claimed to have recognized them as identical with the species in connection with which they have here been given, and not being able to disprove the synonymy, I have accepted the views of these authors.

There still remain certain parasites which I have not been able to classify, namely:

"*Cysticercus aortæ* Notarjanni" is quoted by Tschudi, 1837, 53, as synonym of *Cysticercus cellulosæ*; and "*Cysticercus aorticus* Notar." is mentioned by Moquin-Tandon, 1860, 369, but I have been unable to find the original description; Moquin-Tandon says that the body is oval and provided with filiform hooks.

Cysticercus hepaticus Brera is mentioned by Tschudi, 1837, 53, as a synonym of *Cysticercus cellulosæ*; and Moquin-Tandon, 1860, 369, mentions a *Cysticercus hepaticus* delle Chiaje, with *Trichosoma hepaticus* Brera as synonym. I have been unable to trace these names, unless reference is made to *Finna hepatica* Brera, 1809a, 159; 1810a, pl. 3, fig. 4.

HYDATID DISEASE—ECHINOCOCCOSIS.

[Figs. 124 to 136.]

Hydatid disease or echinococcosis is the infection of any organ with the cystic stage of a very small tapeworm which lives in canines.

Genus ECHINOCOCCUS[a] Rudolphi, 1801.

Generic diagnosis.—*Tæniinæ* (see p. 23): Strobila small (type species less than 7 mm. long), and composed of few segments (type species not over 4 or 5), of which only the terminal (posterior) segment is gravid. Head armed with double row of hooks. Genital pores marginal, irregularly alternate. Cystic stage an *echinococcus*, with or without daughter cysts; several scolices develop in each of the numerous brood capsules. Adults in carnivorous animals, cystic stage in herbivorous and omnivorous mammals.

Type species.—*Echinococcus granulosus* in sheep and calves.

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[a] Synonyms.—*Hydatis* Goeze, 1782a (doubtful whether this is used in a generic sense); *Echinococcus* Rudolphi, 1801; *Acephalocystis* Laennec, 1804 and 1812; *Liococcus* Bremser, 1819a; *Splanchnococcus* Bremser, 1819a; *Acephalocystus* Laennec of Merat, 1821; *Acephalocistis* Cruveilhier, 1829a; ?? *Acrostoma* Lesauvage, 1829; ? *Astoma* Goodsir, 1844d; ? *Diskostoma* Goodsir, 1844; ? *Sphæridium* Goodsir, 1844 (?); *Echinococcifer* Weinland, 1858; *Ecchinococcus* Lebert, 1870a; ? *Discostoma* Braun, 1894a; *Echinokokkus* of various German authors.

The Hydatid Tapeworm—ECHINOCOCCUS GRANULOSUS[a] (Batsch, 1786) Rudolphi, 1805.

[Figs. 124 to 131.]

Specific diagnosis.—*Echinococcus* (p. 75): Strobila very small, 2.5 to 5 mm., exceptionally 6.5 mm. long. Head very small, subglobular, scarcely 0.3 mm. in diameter; rostellum prominent, armed with a double row of 28 to 50 hooklets, the large hooks 22 to 30μ (40 to 45μ Leuckart), the small hooks 18 to 22μ (30 to 38μ Leuckart); suckers 0.13 mm. in diameter; neck continues insensibly into the first portion of the strobila, which is devoid of segmentation. This is followed by the first segment, which is about as broad as long and is sterile. The second segment may be twice as broad and four times as long as the preceding and contains male and female organs. The third (terminal) segment is gravid; it may attain 2 mm. in length by 0.6 mm. in breadth, and contains about 500 eggs. Calcareous corpuscles present. *Male* organs: Cirrus pouch large, 0.5 mm. reaching nearly to median line of segment; testicles 70μ in diameter, about 60 to the segment. *Female* organs: Vagina with large, elongate, setose dilatation 0.05 mm. in diameter; vagina continues caudad into a dilated 0.014 mm. receptaculum seminis; ovaries 2, lobate, submedian, about halfway between genital pore and distal end of segment; vitellogene gland sacular, near distal end of segment; uterus rather late in developing; "shell-gland" apparently absent. Embryophores 32 to 36μ by 25 to 30μ. Habitat, small intestine of carnivorous animals (*Canis*).

Cystic stage may attain the size of a fist or even of a babe's head, but is of slow growth, with thick external lamellated cuticle and thin internal parenchymatic layer; pedunculate brood capsules form from the latter, and in each of these several scolices form. Daughter cysts may also form. Habitat, various organs of herbivorous and omnivorous mammals.

Hosts.—*Of strobila:* Domesticated dog (*Canis familiaris*), wolf (*C. lupus*), jackal (*C. aureus*), dingo[b] (*C. dingo*), cats (*Felis catus domestica*), and probably cougar (*F. concolor*).

Of cystic stage: Not infrequent in man (*Homo sapiens*); more common in the domesticated food-animals, cattle (*Bos taurus*), sheep (*Ovis aries*), goats (*Capra hircus*), swine (*Sus scrofa domestica*); also reported for crab-eating macaque (*Macacus cynomolgus*), Indian lion-tailed macaque (*M. silenus*), Barbary macaque (*Inuus inuus*), the argali (*Ovis ammon*), bactrian camel (*Camelus bactrianus*), dromedary (*C. dromedarius*), giraffe (*Giraffa camelopardalis*), wild boar (*Sus scrofa*), four-horned antelope (*Tetraceros quadricornis*), European elk or moose (*Alce alces*), zebra (*Equus zebra*), horse (*E. caballus*), ass (*E. asinus*), Malayan tapir (*Tapirus indicus*), domesticated dog (*Canis familiaris*), leopard (*Felis pardus*), domesticated cat (*F. catus domestica*), ichneumon (*Herpestes ichneumon*), common European squirrel (*Sciurus vulgaris*), kangaroo (*Macropus major*).

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[a] Synonyms of strobila stage.—*Tænia cateniformis* of Rudolphi, 1808a, 411, misdetermined; *T. cucumerina* Bloch of Diesing, 1850a, in part; *T. serrata* [young] of Rœll, 1852, misdetermined; *T. echinococcus* Siebold, 1853; *T. serrata juvenalis röllii* Kuechenmeister, 1853; *Echinococcifer* Weinland, 1858 (type *T. echinococcus*); *Tenia nana* van Beneden, 1861a; *Echinococcifer echinococcus* (Siebold, 1853) Weinland, 1861; *Tænia echinococca* of Kœberlé, 1861a; *T.* [(*Echinococcifer*)] *echinococcus* of Leuckart, 1863; *T.* (*Arhynchotænia*) *echinococcus* of Diesing, 1864a; *T. nana* (Beneden, 1861) Diesing, 1864a [not Siebold, 1852]; *T. serrata röllii* Kuechenmeister of Diesing, 1864a; *T. echinoccus* Linstow, 1878; *T.* [(*Echinococcus*)] *echinococcus* of Railliet, 1886.

For synonymy of cystic stage see foot notes pp. 77–82.

[b] The form from the dingo is said to attain 10 to 30 mm. in length. If these measurements are correct, this form doubtless represents a new species.

Special medical significance. The cystic stage of echinococcus is found in practically every organ of the human body, but especially in the liver, lungs, and kidneys. It is more common in females than in males, and more common between the ages of 21 and 40 years.

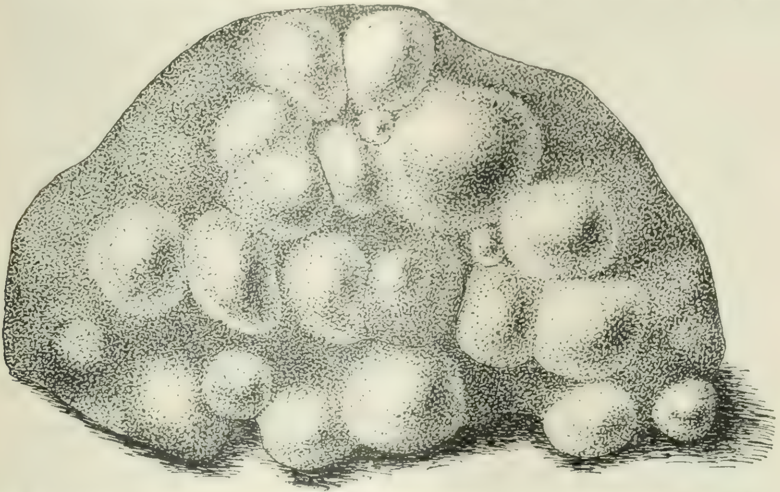

Fig. 124.—Portion of hog's liver infested with echinococcus hydatid. Natural size. (After Stiles, 1898a, 112, fig. 101.)

The symptoms are practically those of pressure from a slowly growing mass. Treatment is surgical.

Prevention. Keep dogs away from slaughterhouses, thus preventing them from becoming infected with the tapeworm by ingestion of the cystic stage found in food animals; avoid undue intimacy with dogs, thus preventing infection from dogs by infection through contamination with the eggs; destroy ownerless dogs.

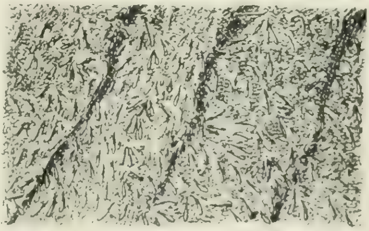

Fig. 125.—Portion of the intestine of a dog infested with the adult Hydatid Tapeworm (*Echinococcus granulosus*). Natural size. (After Ostertag, 1895, 430, fig. 99.)

Modifications in form.—The cystic stage of *Echinococcus* assumes various modifications, to which different names have been given, either by intentional renaming of forms already known or under the assumption that the forms in question represented distinct species. Several names[a] have been proposed as general designations to include all of these modifications.

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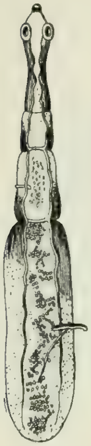
[a] General names, including several or all modifications: *Echinococcus infusorium* Leuckart, 1827; *Polycephalus volvox* Tschudi, 1837; *P. echinococcus* Tschudi, 1837; ?*E. variabilis* Siebold, 1837, not accessible (see *E. variabilis* Huxley, 1852); *E. polymorphus* Diesing, 1850a; *E. cysticus* Huber, 1891b; *E. unilocularis* Huber, 1896a.

Several other names[a] have been based upon the names of the hosts in which the parasites occur, thus intimating that they are viewed as distinct or probably distinct species.

A number of names[b] have been based upon the organs in which the parasites occur.



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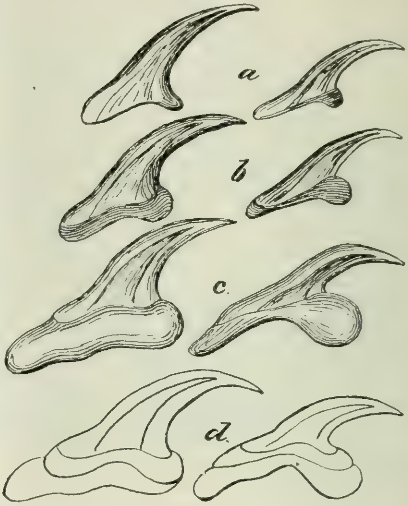

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Fig. 126.—Adult Hydatid Tapeworm (*Echinococcus granulosus*). Enlarged. (After Leuckart, 1880, 743, fig. 316.)

Fig. 127.—Hooks of Hydatid Tapeworm: *a*, from a hydatid; *b*, three weeks after feeding to a dog; *c*, from an adult; *d*, combined figures of *a–c*, showing the gradual changes in form. ×600. (After Leuckart, 1880, 736, fig. 315.)

Quite a large number of names have been based upon modifications in growth, but to understand these we must consider the method of development.

When the six-hooked embryo (onchosphere) comes to rest in an organ, it gradually increases in size. After a time it consists of a thick external lamellated cuticle and an inner parenchymatic layer surrounding a lumen containing a fluid. This is the stage described as the *Acephalocystis*,[a] the name being based upon the absence or the supposed absence of heads. As a matter of fact, the so-called acephalocysts probably contained heads in not a few cases, but as these scolices are small they might have been overlooked. Not all so-called acephalocysts are true echinococci.

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[a] Names based upon the names of hosts: *Polycephalus hominis* Zeder, 1800a; *P. humanus* Zeder, 1803a; *Acephalocystis humana* Luedersen, 1808; *A. suilla* Luedersen, 1808; *Echinococcus hominis* (Zeder, 1800) Rudolphi, 1810a; *E. simiæ* Rudolphi, 1810a (*Hydatis erratica* Blumenbach, 1805, renamed); *E. simiæ cynomolgi* Oken, 1815; *E. suis* author? date?; *E. girafæ* Gervais, 1847a; *E. arietis* E. Blanchard, 1848; *E. giraffæ* Diesing, 1850a; *E. pardi* Huxley, 1852?; "*Acephalocystis macaci* ?" Cobbold, 1861e; ? *Acephalocystis ovis tragelaphi* Cobbold, 1861e.

[b] Names based upon organs in which the parasites occur: *Echinococcus cerebri* Spiering, 1862; *E. hepatis* Scholler, 1862, and Kehlberg, 1873; *E. process. vermiformis* Scholler, 1862; *E. lienis* Ber. Krankenanst. Rudolf-Stiftung, Wien, 1867, and Kehlberg, 1873; *E. pulmonum* Huppert, 1875a; *E. intracranialis* Fricke, 1880a (*E. intercranialis* of Stiles, 1896, misprint); *E. retroperitonealis* Bitter, 1886a (*E. retroperitonialis* of Stiles, misprint); *E. mesenterii* Surmann, 1891; *E. subdiaphragmalis-præperitonealis* Krasnoff, 1895a; *E. cerebralis* Perroncito, date? (probably based on "*Echinococchi cerebrali*" Perroncito, 1882, p. 172); *E. subphrenicus* Huber, 1896a.

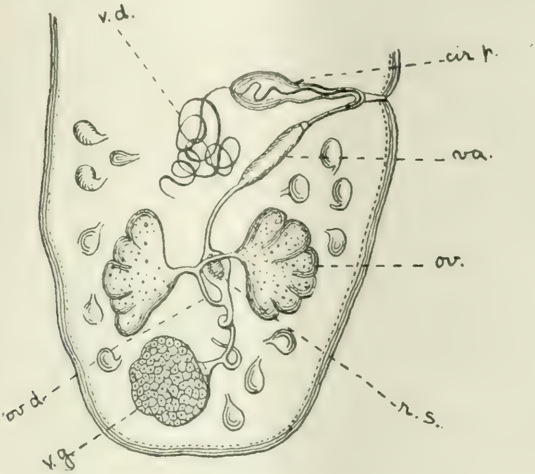

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FIG. 128.—Sexual organs of adult tapeworm, *Echinococcus granulosus: cir. p.*, cirrus pouch; *ov.*, ovary; *ov. d.*, oviduct; *r. s.*, receptaculum seminis; *va.*, vagina; *v. d.*, vas deferens; *v. g.*, vitellogene gland. Enlarged. (After Leuckart, 1886, 747, fig. 318.)

The brood-capsules may form directly on the parenchymatic layer, thus giving a granular appearance to the parasite, and this is evidently the explanation of the use of the name *granulosus* by several authors.

In other cases daughter cysts form and are found floating in the fluid of the mother cysts; granddaughter cysts may form in the daughter cyst; brood capsules may form in the mother cyst, the daughter cysts, and the granddaughter cysts. This variation with endogenous formation of secondary cysts is reported especially for man, and has been described under several different names.[a]

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[a] Names based on the acephalocyst: *Acephalocystis* Lænnec, 1804; *A. humana* Luedersen, 1808; *A. suilla* Luedersen, 1808; *A. ovoidea* Lænnec, 1812; *A. cystifera* Lænnec, 1812; *A. ansa* Lænnec, 1812; *A. intersecta* Lænnec, 1812; *A. surculigera* Lænnec, 1812; *A. granosa* Lænnec, 1812; [*A. plana* Lænnec, 1812 = *Ovuligera carpi* Dupuytren, is not an echinococcus]; *Acephalocystus communis* Merat, 1821; *Acephalocystis communis* Lænnec, 1825; *A. eremita* Cruveilhier, 1829a; *A. sterilis* Cruveilhier, 1829a; *A. socialis* Cruveilhier, 1829a; *A. prolifera* Cruveilhier, 1829a; *Acephalocistis socialis* Cruveilhier, 1829a; *A. prolifera* Cruveilhier, 1829a; *Acephalocystis endogena* Kuhn, 1830 and 1832 (*A. socialis* vel *prolifera* renamed); *A. exogena* Kuhn, 1830 and 1832 (*A. eremita* vel *sterilis* renamed); *A. granulosa* delle Chiaje, 1833 (for *A. granosa* Lænnec); *A. prolifera socialis* Cruveilhier of delle Chiaje, 1833a; *A. eremita sterilis* Cruveilhier of delle Chiaje, 1833a; *A. simplex* Goodsir, 1844d; "*A. macaci ?*" Cobbold, 1861e; ? *A. ovis tragelaphi* Cobbold, 1861e.

In another variation in growth, found particularly in ruminants, the daughter cysts escape externally from the mother cysts. This is referred to as an exogenous formation; that daughter cysts may form

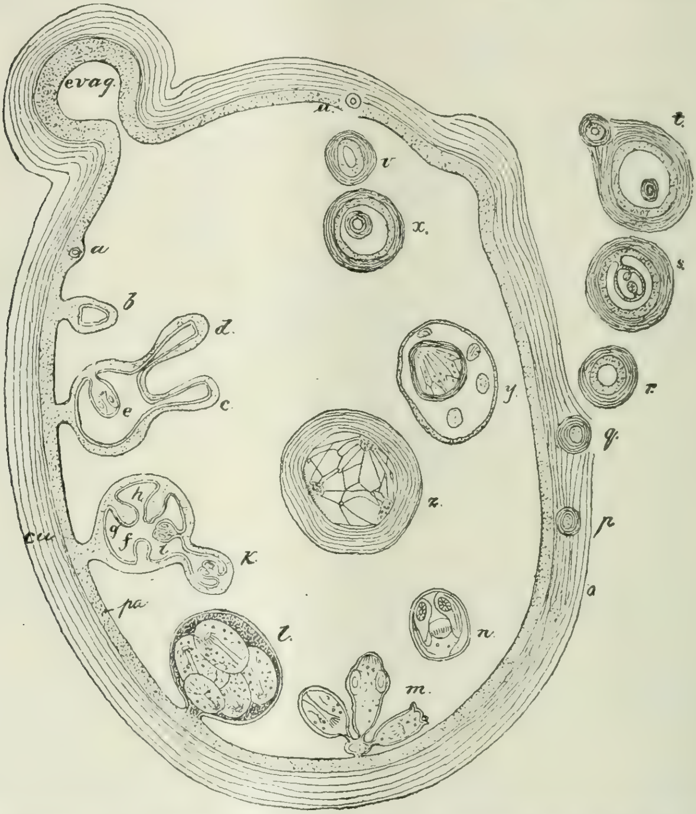

FIG. 129.—Diagram of an Echinococcus hydatid: *cu*, thick external cuticle; *pa*, parenchym (germinal) layer; *c*, *d*, *e*, development of the heads according to Leuckart; *f*, *g*, *h*, *i*, *k*, development of the heads according to Moniez; *l*, fully developed brood capsule with heads; *m*, the brood capsule has ruptured, and the heads hang in the lumen of the hydatid; *n*, liberated head floating in the hydatid; *o*, *p*, *q*, *r*, *s*, mode of formation of secondary exogenous daughter cyst; *t*, daughter cyst with one endogenous and one exogenous granddaughter cyst; *u*, *v*, *x*, formation of exogenous cyst, after Kuhn and Davaine; *y*, *z*, formation of endogenous daughter cysts, after Naunyn and Leuckart; *y*, at the expense of a head; *z*, from a brood capsule; *evag.*, constricted portion of the mother cyst. (After R. Blanchard, 1886a, 426, fig. 257, slightly modified.)

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[a] Names applied especially to the variation found more commonly in man, usually with endogenous formation of secondary cysts: *Polycephalus hominis* Zeder, 1800a; *P. humanus* Zeder, 1803a; *P. echinococcus* Zeder, 1803a; *Echinococcus hominis* (Zeder, 1800) Rudolphi, 1810a; *Liococcus* Bremser, 1819a; *Splanchnococcus lævis* Bremser, 1819a; *Echinococcus altricipariens* Kuechenmeister, 1855a; *Cysticercus echinococcus* (Zeder, 1803) Kœberlé, 1861a; *Echinococcus hydatidosus* Leuckart, 1863; *E. endogena* (Kuhn, 1830) Leuckart, 1863.

in all cases does not appear to have been demonstrated, but the cysts in animals have given rise to a number of additional names.[a]

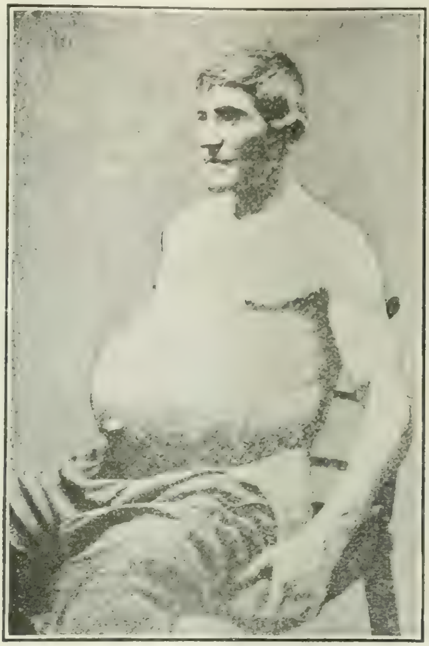

FIG. 130.—Echinococcus cyst in the liver of a man 50 years old. (After Huber, 1896a, 523, fig. 73.)

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[a] Names introduced especially for the cystic stage as it occurs in domesticated animals, and in many instances associated with exogenous daughter cysts: *Tænia visceralis socialis granulosa* Gœze, 1782a (from sheep and calves); *Hydatigena granulosa* Batsch, 1786a; *Vesicaria granulosa* (Batsch, 1786) Schrank, 1788; *Tænia visceralis granulosa* Gœze of Schrank, 1788; *T. granulosa* (Batsch, 1786) Gmelin, 1790a; *Polycephalus granulosus* (Batsch, 1786) Zeder, 1803a; *Echinococcus granulosus* (Batsch, 1786) Rudolphi, 1805, and Leuckart, 1863; *Tænia hydatigena granulosa* Rudolphi, 1805; *Echinococcus veterinorum* Rudolphi, 1810a (*Hydatigena granulosa* Batsch, 1786, renamed); *Polycephalus granosus* Lænnec, 1812; *Tænia granosa* Gmelin of Lænnec, 1812; *T. visceralis socialis granosa* Gœze of Lænnec, 1812; *Splanchnococcus echinatus* Bremser, 1819a; *Tænia visceralis socialis granulosa* Gœze of Diesing, 1850a; *Echinococcus scolecipariens* Kuechenmeister, 1855a (*E. veterinorum* Rudolphi, 1810, renamed); *E. cœnuroides* Kuechenmeister, 1855a (*E. veterinorum* Rudolphi, 1810, renamed); *Tænia echinococcus scolecipariens* Kuechenmeister, 1855a; *Echinococcus simplex* Leuckart, 1886 (*E. scolecipariens* Kuechenmeister, 1855, renamed); *E. exogena* (Kuhn, 1830) Blanchard, 1886a; *E. scolicipariens* Kuechenmeister of Stiles, 1898a, misprint.

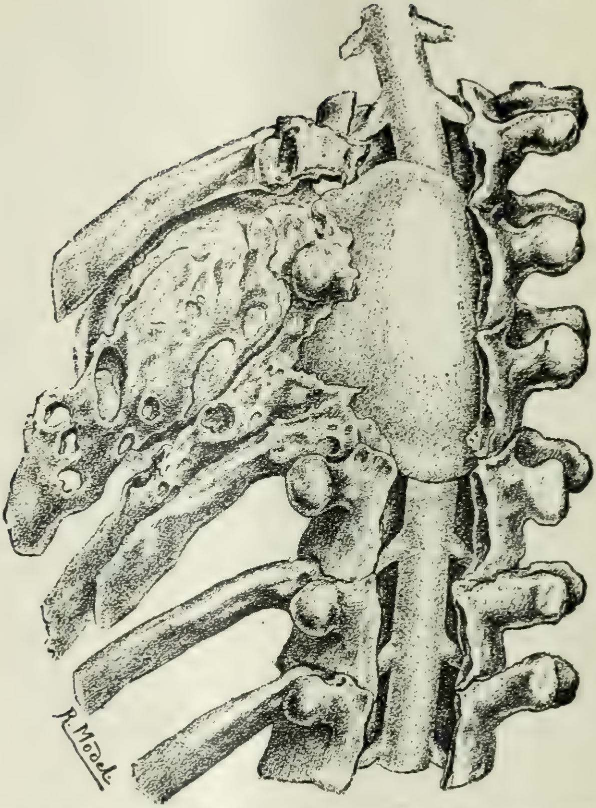

FIG. 131.—Echinococcus cyst of the spinal canal. (After Bellencontre; from Huber, 1896a, 550, fig. 76.)

Still other names[a] have been proposed by various authors under various other circumstances.

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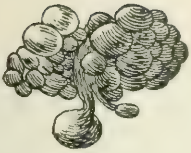
[a] Miscellaneous names: *Hydatides singulares* Pallas, 1766, refers to echinococcus cysts in man and animals; *Hydatis erratica* Blumenbach, 1805a, renamed *E. simiæ* Rudolphi, 1810a; *Finna idatoides* Brera, 1810a, in man; *Hydatis simplex* Home is quoted by delle Chiaje, 1833a, in connection with *Acephalocystis eremita sterilis; ? Astoma acephalocystis* Goodsir, 1844a; *? Diskostoma acephalocystis* Goodsir, 1844a; *Echinococcus variabilis* Huxley, 1852a; *E. unilocularis* Haffter, 1875a, apparently as distinction from *E. multilocularis; E. multiplex* Stiller, 1882.



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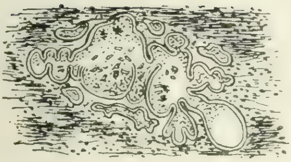

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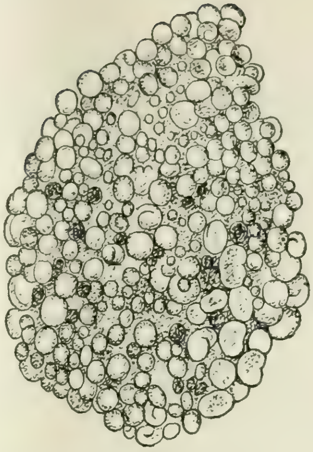

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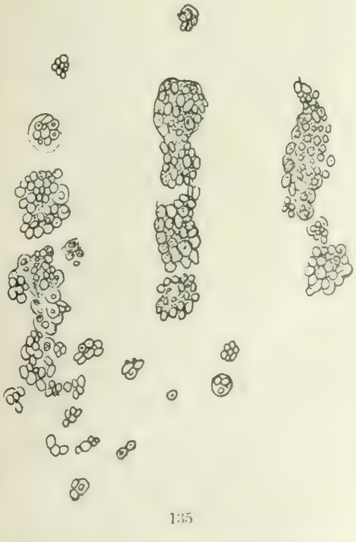
Fig. 132.—A racemose Echinococcus. Natural size. (After Leuckart, 1880, 795, fig. 334.)

Fig. 133.—Section through a multilocular Echinococcus. × 30. (After Leuckart, 1880, 796, fig. 335.)

Fig. 134.—A multilocular Echinococcus from the liver of a steer. Natural size. (After Ostertag, 1895, 427, fig. 94.)



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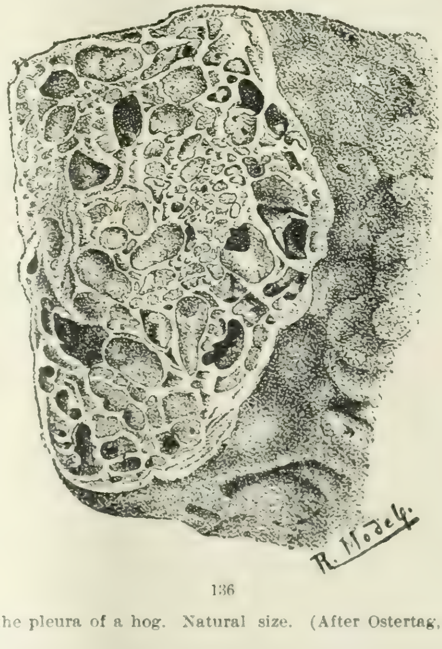

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Fig. 135.—A multilocular Echinococcus from the pleura of a hog. Natural size. (After Ostertag, 1895, 428, fig. 97.)

Fig. 136.—A multilocular Echinococcus. (After Luschka; from Huber, 1896a, 510, fig. 72.)

The Multilocular Echinococcus—ECHINOCOCCUS GRANULOSUS MULTILOCULARIS[a] **(Leuckart, 1863) Stiles, 1905.**

[Figs. 132 to 136.]

A peculiar form of echinococcus cyst occurs in man and animals in certain localities, especially in Russia, Bavaria, Switzerland, Austrian Alps, and Wuerttemberg. Opinion differs as to whether it represents a distinct species or simply a modification of the ordinary form. It is here recognized as a subspecies.

SUBSPECIFIC DIAGNOSIS.—*Echinococcus granulosus* (p. 76): Strobila similar to that of the type form; some slight differences are reported, but these require further study and confirmation.

Cystic stage attains the size of a fist or even of a child's head, and represents a mass of numerous small cysts, 0.1 to 5 mm. in diameter; these cysts may communicate, according to some authors, or the cuticular layers are connected; brood capsules may be present; some of the cysts contain 1 to several heads, others are without scolices. This parasite is especially likely to undergo degeneration and represents the alveolarcolloid of certain authors.

HABITAT.—Cystic stage, especially in liver, but also in brain, spleen, suprarenal capsules, and secondarily through metastasis in various abdominal organs, also in lungs, heart, etc., of man, cattle, sheep, and swine. Adult strobila in dogs.

SPECIAL MEDICAL SIGNIFICANCE.—The nature of this parasitic growth was long misunderstood. Zenker has shown that the parasites are located in the lymphatic vessels; but they show a pronounced tendency to grow into other channels, especially into the bile ducts. They cause a very serious condition which, in man, nearly always results fatally.

PREVENTION.—Same as for the ordinary echinococcus, see p. 77.

Family DIBOTHRIOCEPHALIDÆ.

Collective Group SPARGANUM Diesing, 1855.

GENERIC DIAGNOSIS.—*Dibothriocephalidæ:* (p. 14) An artificial collective group to contain larval stages of bothriocephalid worms, which have not reached a stage in their development that they can be determined generically.

Such groups do not require a type species.

In man are found two immature parasites, which may be classified here. They are distinguished as follows:

KEY TO THE SPECIES OF SPARGANUM FOUND IN MAN.

Worms attain 8 to 36 cm. in length and do not reproduce by fission or by the formation of supernumerary heads; Asia, ?Egypt, and South America..*Sparganum mansoni* (p. 85).

Worms attain 1 to 12 mm. in length and may reproduce by fission and by the formation of supernumerary heads; Japan....................*S. proliferum* (p. 86).

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[a] SYNONYMS.—Die multiloculäre, ulcerirende Echinokokkengeschwulst Virchow, 1856; *Echinococcus multilocularis* Leuckart, 1863; Tumeur hydatique alvéolaire Carrière, 1868a; *Echinococcus multilocularis hepatis* Haffter, 1875a; *E. alveolaris* Klemm, 1883a, and Blanchard, 1886a; *?E. racemosus* Leuckart, 1886; *E. multilocularis exulcerans* Huber, 1896a; *E. osteoklastes* Huber, 1896a; *Tænia echinococcus alveolaris* (Klemm, 1883) Devé, 1905.

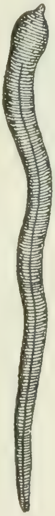
Manson's Larval Tapeworm—SPARGANUM MANSONI[a] (Cobbold, 1882) Stiles & Tayler, 1902.

[Figs. 137 to 143.]

SPECIFIC DIAGNOSIS.—*Sparganum:* Length, 8 to 36 cm.; breadth, 0.1 to 12 mm.; thickness, 0.5 to 1.75 mm. Anterior end may be broader than posterior. Flat, not segmented, but with irregular transverse folds; ventral surface usually with distinct longitudinal median groove; dorsal surface may show two longitudinal grooves. Anterior margin rounded, with papilliform elevation, on which is found the head. The latter somewhat compressed and more or less invaginated.

HABITAT.—Superitoneal connective tissue and body cavity of man (*Homo sapiens*) and ? jackals (*Canis aureus*).

GEOGRAPHIC DISTRIBUTION—Amoy and Japan; Daniels reports a similar, perhaps identical, form for Guiana, and Sonsino for Egypt.



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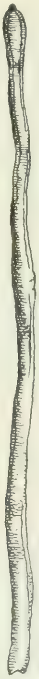

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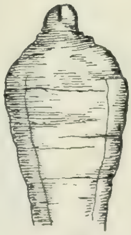

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FIG. 137.—*Sparganum mansoni.* Natural size. (After Cobbold, 1883, fig. a.)
FIG. 138.—Another specimen of same. Natural size. (After Leuckart, 1886, 942, fig. 402a.)
FIG. 139.—Head end of same. × 5. (After Leuckart, 1886, 950, fig. 405.)

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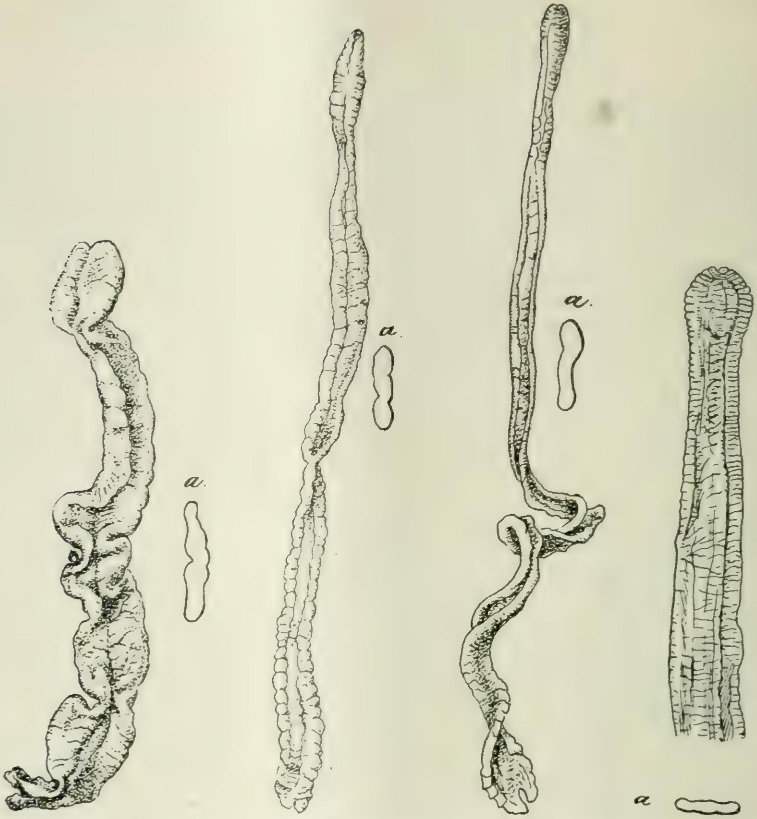
[a] SYNONYMS.—*Ligula mansoni* Cobbold in Manson, 1882; *Bothriocephalus liguloides* Leuckart, 1886; *B. mansoni* (Cobbold, 1882) R. Blanchard, 1888; *Legula mansoni* Cobbold of Huber, 1896a, misprint; *Bothriocephalus leguloides* Leuckart of Huber, 1896, misprint; *B. linguloides* Leuckart of Simon, 1897, misprint; *Dibothrium mansoni* (Cobbold, 1882) Ariola, 1900; *Leguli mansoni* Huber of Stiles & Tayler, 1902, misprint.

BIBLIOGRAPHY.—For full bibliography and compilation of cases see Stiles & Tayler, 1902, 47–56, figs. 29–36.



FIGS. 140 to 143.—Four different specimens of *Sparganum mansoni*: *a*., cross sections. Figs. 140 to 142 natural size; fig. 143 × 2. (After Ijima & Murata, 1888a, figs. 1, 3, 4, 5.)

The Proliferating Japanese Tapeworm Larva—SPARGANUM PROLIFERUM[a]
(Ijima, 1905) Stiles, 1906.

[Figs. 144 to 166.]

SPECIFIC DIAGNOSIS.—*Sparganum:* Larva may attain 1 to 12 mm. in length and 2.5 mm. in breadth; head narrower and more motile than posterior end, and may show an apical depression which, perhaps, serves as sucker; no true suckers or other organs of attachment present. Calcareous corpuscles spherical or ellipsoidal, 7.5 to 12*μ* in diameter, and situated in any part of body except head; irregularly distributed reserve-food bodies present in older specimens, but they later undergo disintegration; genital organs not present; longitudinal muscles better developed than either dorso-ventral or transverse system; transverse fibers do not divide body into cortical and medullary layers; excretory system well developed, consisting of larger approximately longitudinal branches, with anastomoses. The larvæ possess the power of multiplying by transverse fission and of forming supernumerary heads which may become independent. Adult unknown.

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[a] SYNONYMS.—*Plerocercoides prolifer* Ijima, 1905; *Plerocercus prolifer* Ijima, 1905. Neither *Plerocercoides* (type *bailleti*) nor *Plerocercus* is available in naming this species. Because of the remarkable reproduction of the larval stage, a new genus would probably be justified, but there are some advantages in placing the worm, at least for the present, in the collective group *Sparganum*.

BIBLIOGRAPHY.—See Ijima, 1905.

HABITAT.—Encysted in subcutaneous tissue and elsewhere of man.

GEOGRAPHIC DISTRIBUTION.—Reported but once, Tokyo, Japan.

MEDICAL SIGNIFICANCE.—In the single case reported thousands of parasites were present; they gave rise to acme-like swellings, to an enlarged condition of the thigh resembling elephantiasis; and to their presence in the region of Poupart's ligament was attributed an inguinal hernia.

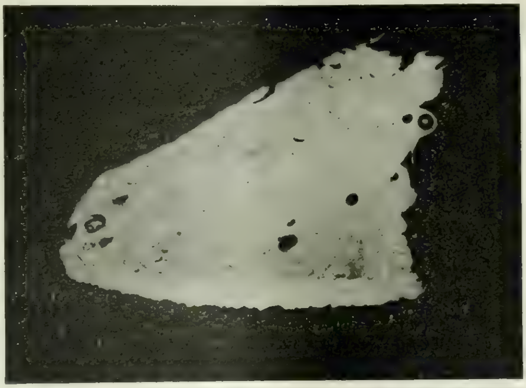


FIG. 144.—A vertical section of the skin and subdermal tissue from left thigh, showing numerous cysts of *S. proliferum*. (After Ijima, 1905, fig. 1.)

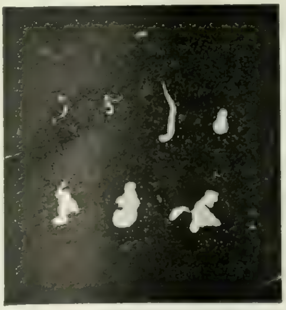
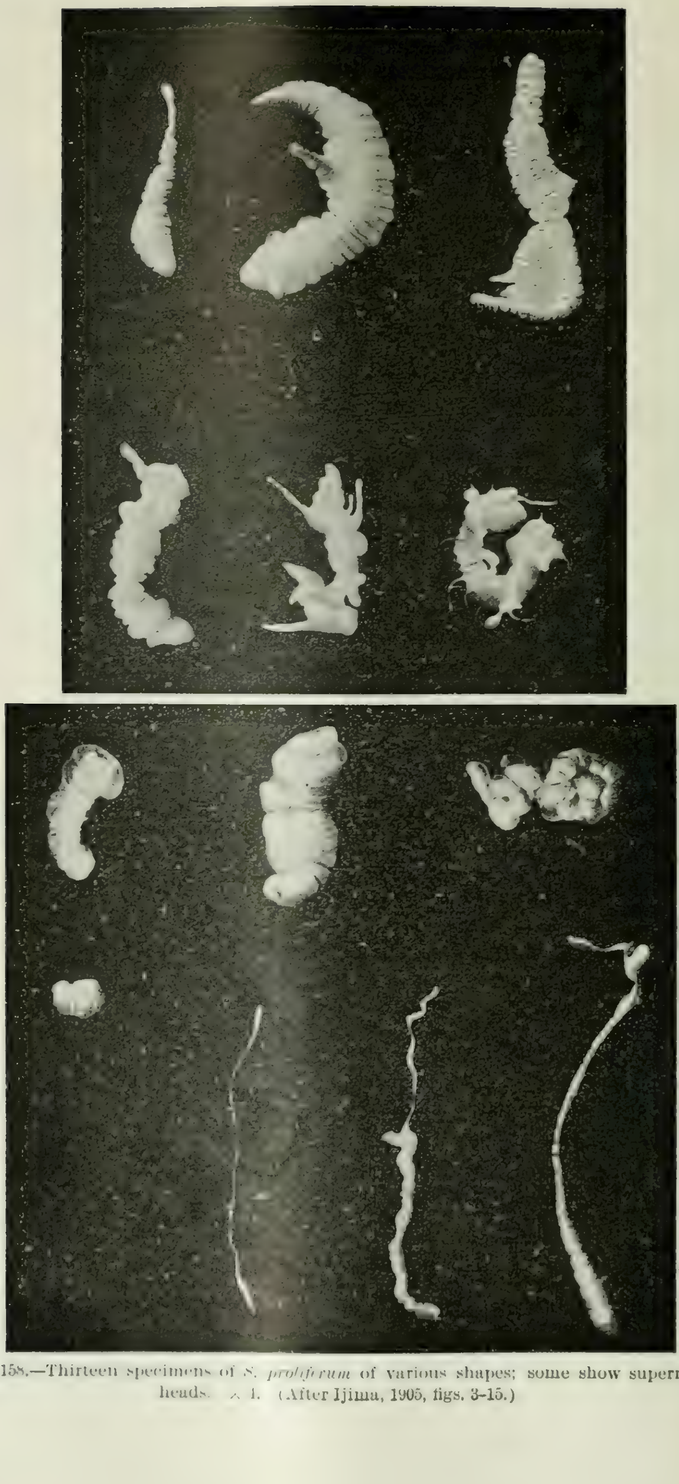


FIG. 145.—Seven separate pieces of *S. proliferum* taken from one cyst. × 1¼. (After Ijima, 1905, fig. 2.)



FIGS. 146–158.—Thirteen specimens of *S. proliferum* of various shapes; some show supernumerary heads. × 1. (After Ijima, 1905, figs. 3–15.)

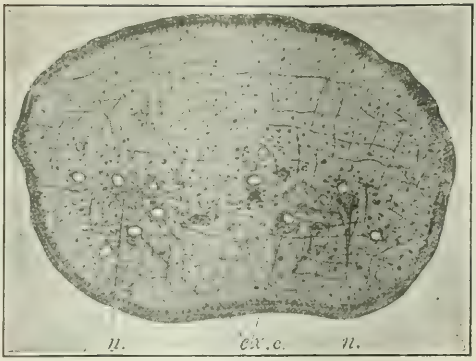
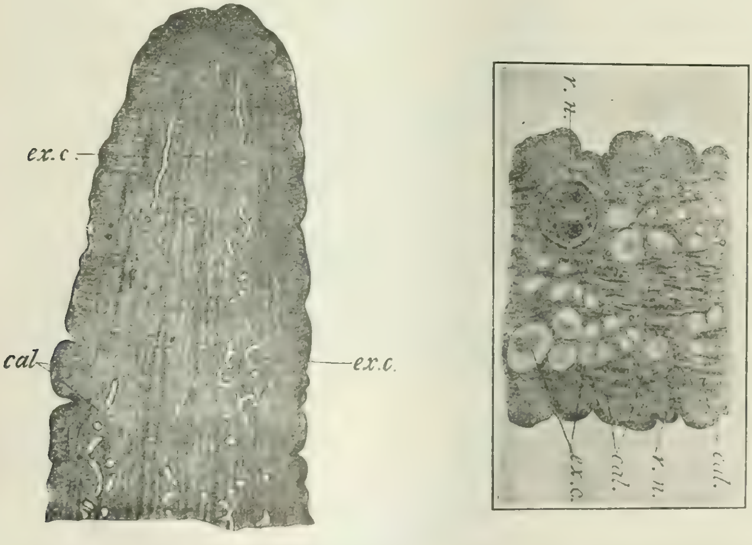


FIG. 159.—Transverse section of head region of *S. proliferum: ex. c.*, excretory canals; *n.*, lateral nerves. × 100. (After Ijima, 1905, fig. 16.)



FIGS. 160-161.—Longitudinal section of (160) head and (161) near posterior end of *S. proliferum: cal.*, calcareous corpuscles; *ex. c.*, excretory canals. × 50. (After Ijima, 1905, fig. 21.)

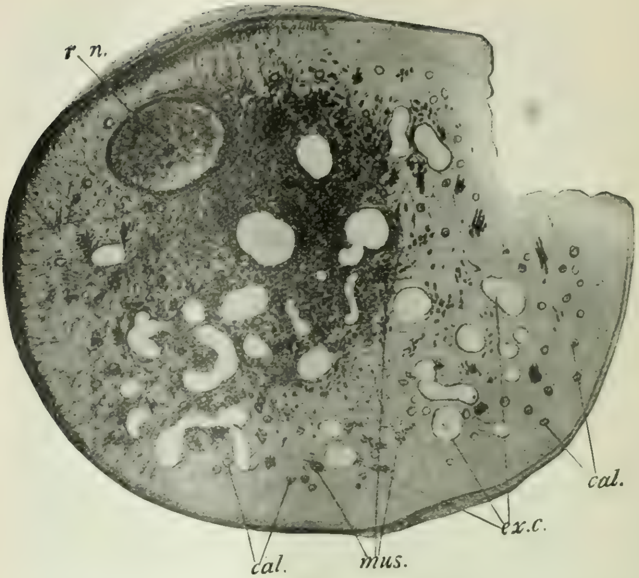


Fig. 162.—Transverse section of posterior portion of *S. proliferum*: *cal.*, calcareous corpuscles; *ex. c.*, excretory canals; *mus.*, muscles; *r. n.*, reserve nutritive material. × 100. (After Ijima, 1905, fig. 17.)

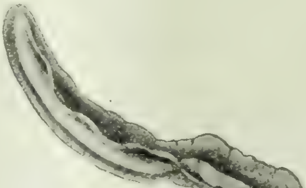


Fig. 163.—Head end of *S. proliferum* fully stretched; excretory vessel in part strongly swollen. × 30. (After Ijima, 1905, fig. 18.)

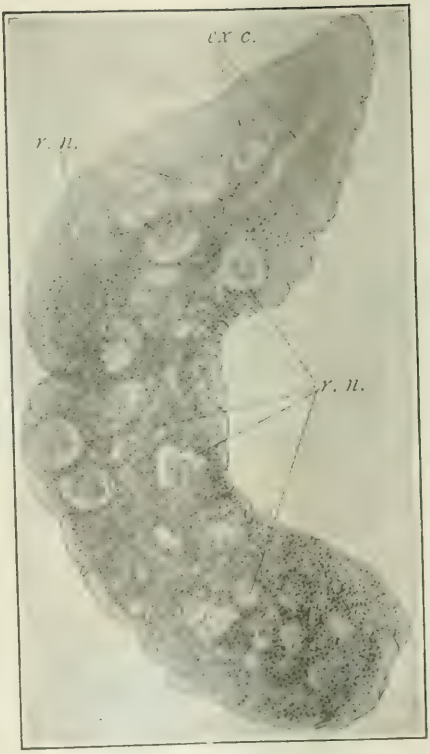


FIG. 164.—An entire *S. proliferum*, overstained with carmine, then bleached with caustic potash: black dots represent calcareous corpuscles; *ex. c.*, excretory vessels; *r. n.*, reserve nutritive matter. × 30. (After Ijima, 1905, fig. 19.)

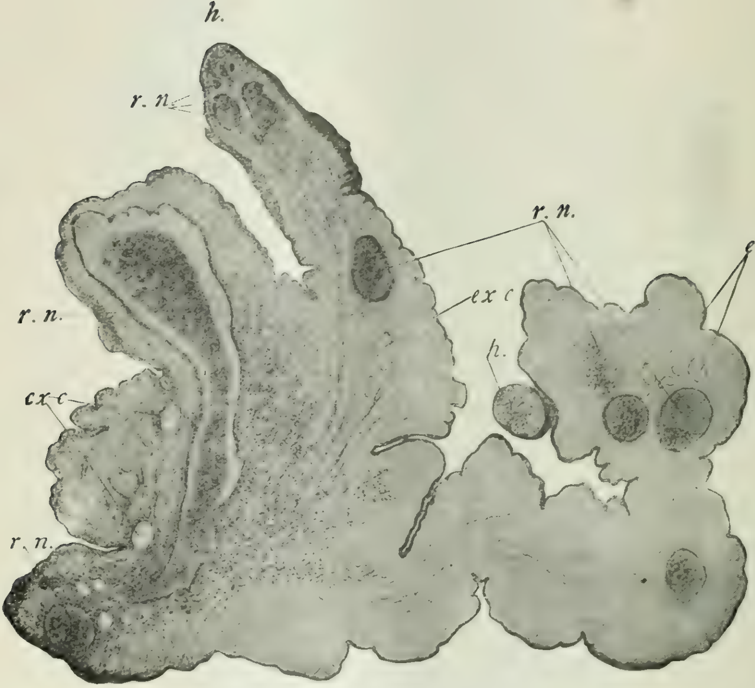


FIG. 165.—Section of budding *S. proliferum*, showing heads (*h*) in two places. × 50. (After Ijima, 1905, fig. 20.)

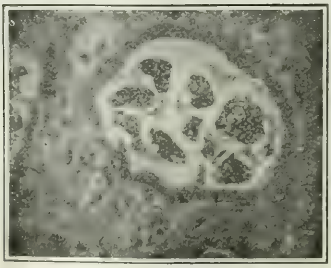


FIG. 166.—Section of a cyst of *S. proliferum* in subdermal connective tissue. × ca. 8. (After Ijima, 1905, fig. 23.)

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The short bibliographic references used in this paper are taken from Stiles & Hassall, 1902–5, Index-Catalogue of Medical and Veterinary Zoology.

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